tember-October 1954

Communications—Electronics—Photography

SIGNAL

ARMED FORCES COMMUNICATIONS ASSOCIATION

F

Out of the Night Came a Call for Help

Quick action of alert telephone operator helps save man with heart attack

Awarded Vail Medal. Mrs. Carolyn F. Gross, night operator in Berlin, N. J. Awarded Vail Medal for "initiative and resourcefulness" in answering an emergency call. Vail Medals, accompanied by cash awards, are given annually by the Bell System for acts of noteworthy public service by telephone employees throughout the country.

It was about two o'clock of an August morning when the call flashed on the switchboard. A woman, in an excited voice, asked to be connected with a doctor.

Mrs. Carolyn F. Gross, the night operator, rang the doctor's home immediately but he was unavailable. Sensing a critical emergency, she asked if she could be of help in getting another doctor.

"Oh, please do everything you can," implored the caller. "My husband has had a heart attack and is very ill."

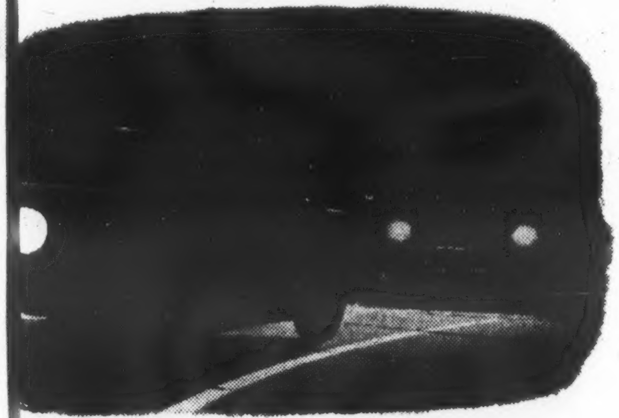
Mrs. Gross rang a doctor who had helped in a previous emergency. Then, realizing he was new in the area, she arranged to have the State Police meet him at a certain point and lead him to the house.

Shortly after, the subscriber's daughter called to ask for oxygen.

"It's on the way," said Mrs. Gross. "I thought you might need it so I telephoned the emergency ambulance service. They ought to be there any minute."

Just before she went off duty, Mrs. Gross called to ask how the sick man was doing and if there was anything else she could do.

"You've already done so much," said a grateful voice. "The doctor says that it's only because of your help that my husband is alive."



Police Escort. To help the doctor get there faster, the operator arranged for the State Police to escort him to the sick man's home.

Ever Ready . . . Ever Helpful. *Day or night, rain or shine, the telephone stands ready to help you—in the everyday affairs of life as well as emergencies. This swift, willing worker will run your errands, guard your home, save countless steps and valuable time and keep you in touch with relatives and friends. In office and home, these oft-repeated words reveal its value—"I don't know what I'd do without the telephone."* **BELL TELEPHONE SYSTEM**

SIGNAL

Communications-Electronics-Photography
Journal of the Armed Forces Communications Association

VOLUME 9 — SEPTEMBER-OCTOBER 1954 — NUMBER 1

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FEATURES

DEPARTMENTS

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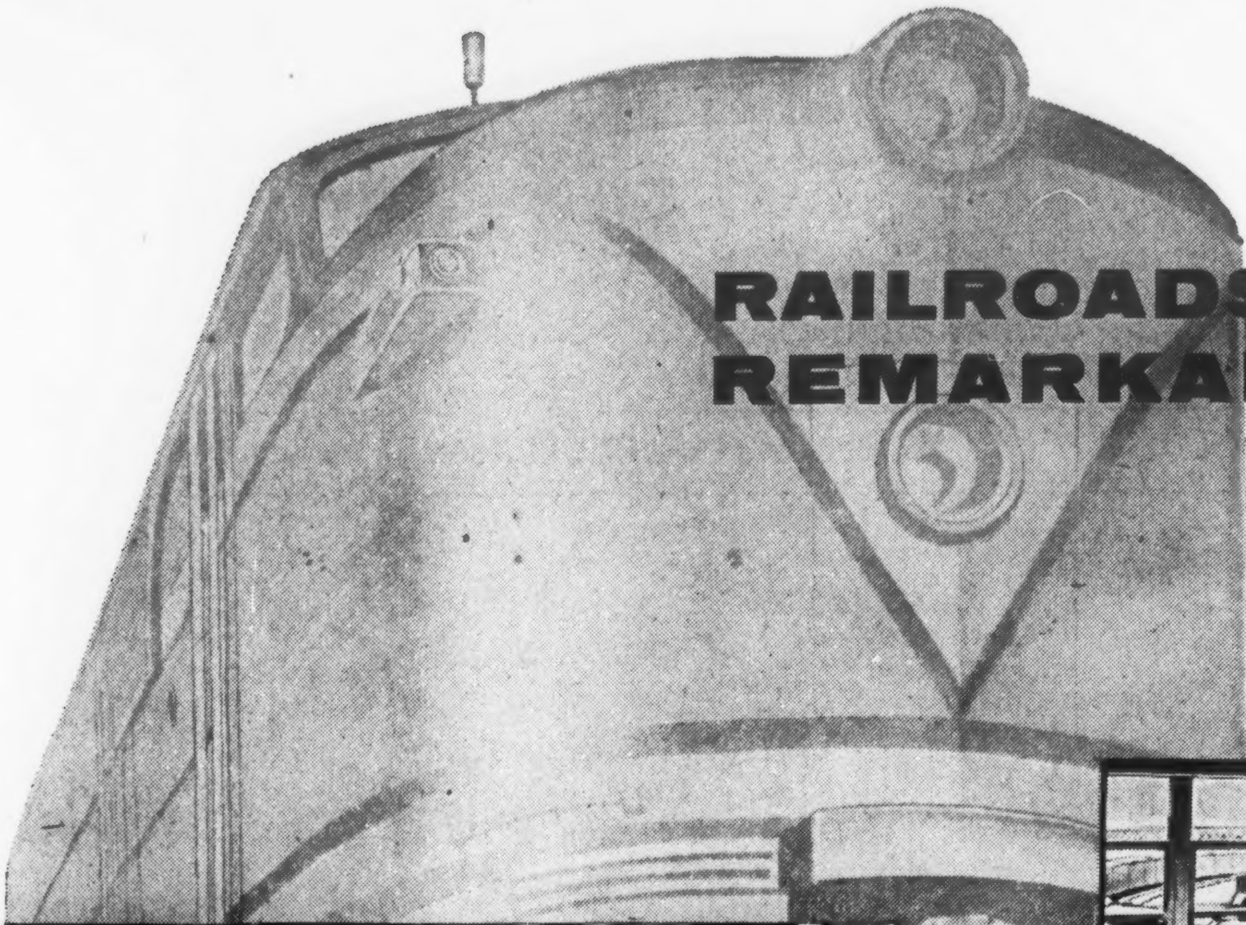
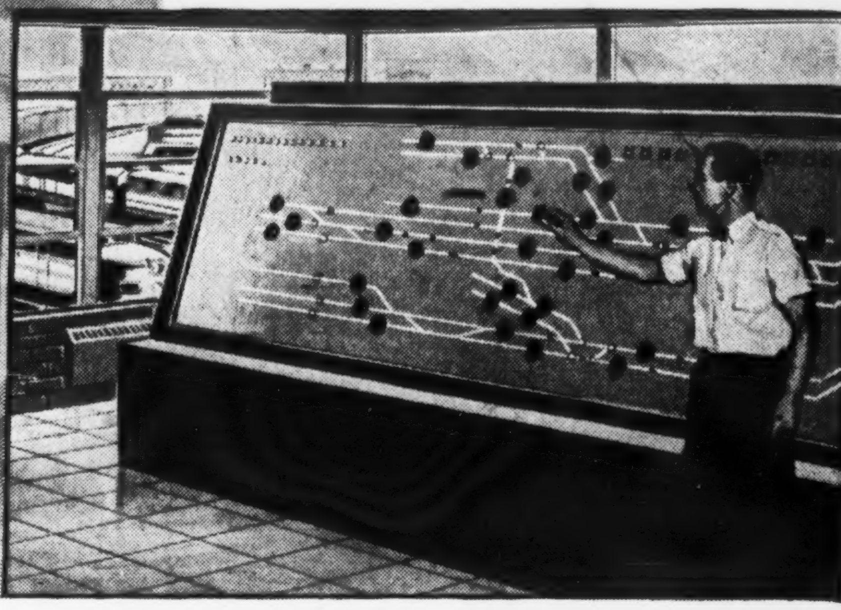


RAILROADS ARE DOING REMARKABLE THINGS

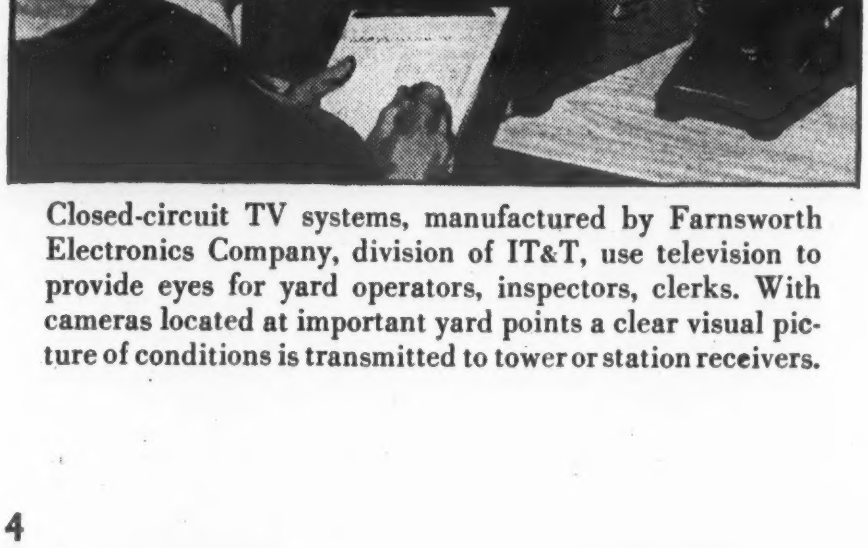
with IT&T signalling
and communications systems
for greater operating
simplicity, safety, efficiency
and economy.

With Federal's mobile train radio systems, compact transmitters and receivers in engines, cabooses, wayside stations, towers, give railroads instant communications with moving trains. Stations, engineers, conductors, towermen, yardmen can all be in touch with each other at any time to pass information and instructions. Passenger-car public address and entertainment systems are also provided by Federal Telephone and Radio Company.



A vital new development is the IT&T Sequence Switch Interlocking System for railroad signalling. Used by the Rock Island at Gresham, Ill., one of the most complex network of rail lines in the world, one towerman controls the whole area merely by turning knobs on his control panel. This system, available now through Federal Telephone and Radio Company, a division of IT&T, provides quick automatic dependable route-setting—handling greater traffic faster and with full protection against conflicting train movements.

PIONEERS in the development of electrical and electronic telecommunication systems, IT&T and its divisions contribute every day to progress in our railroads and other industries. A wide range of products for industry, business and the home benefit from the skill, resources and facilities that have made IT&T a great American trademark.



Closed-circuit TV systems, manufactured by Farnsworth Electronics Company, division of IT&T, use television to provide eyes for yard operators, inspectors, clerks. With cameras located at important yard points a clear visual picture of conditions is transmitted to tower or station receivers.

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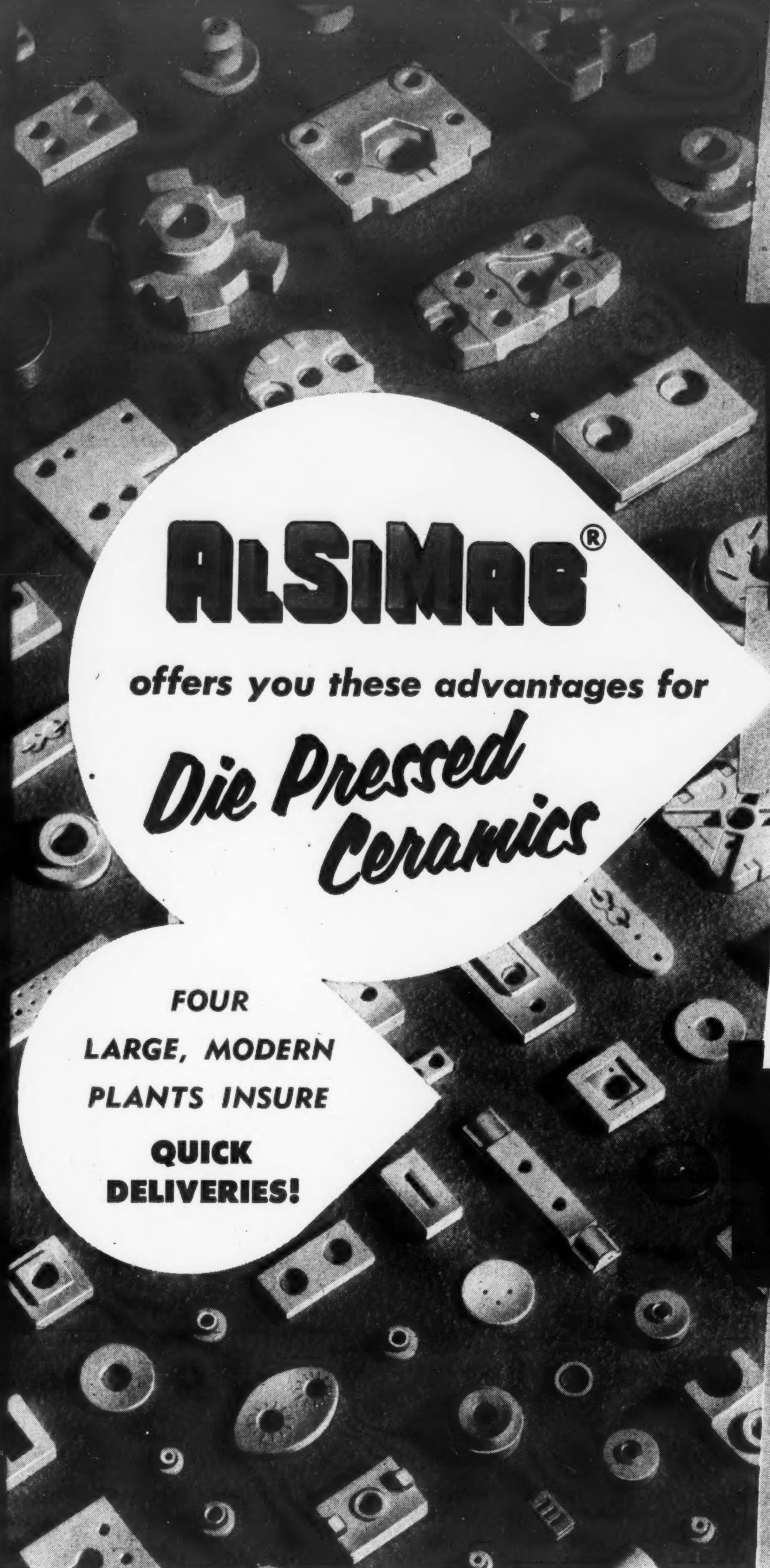

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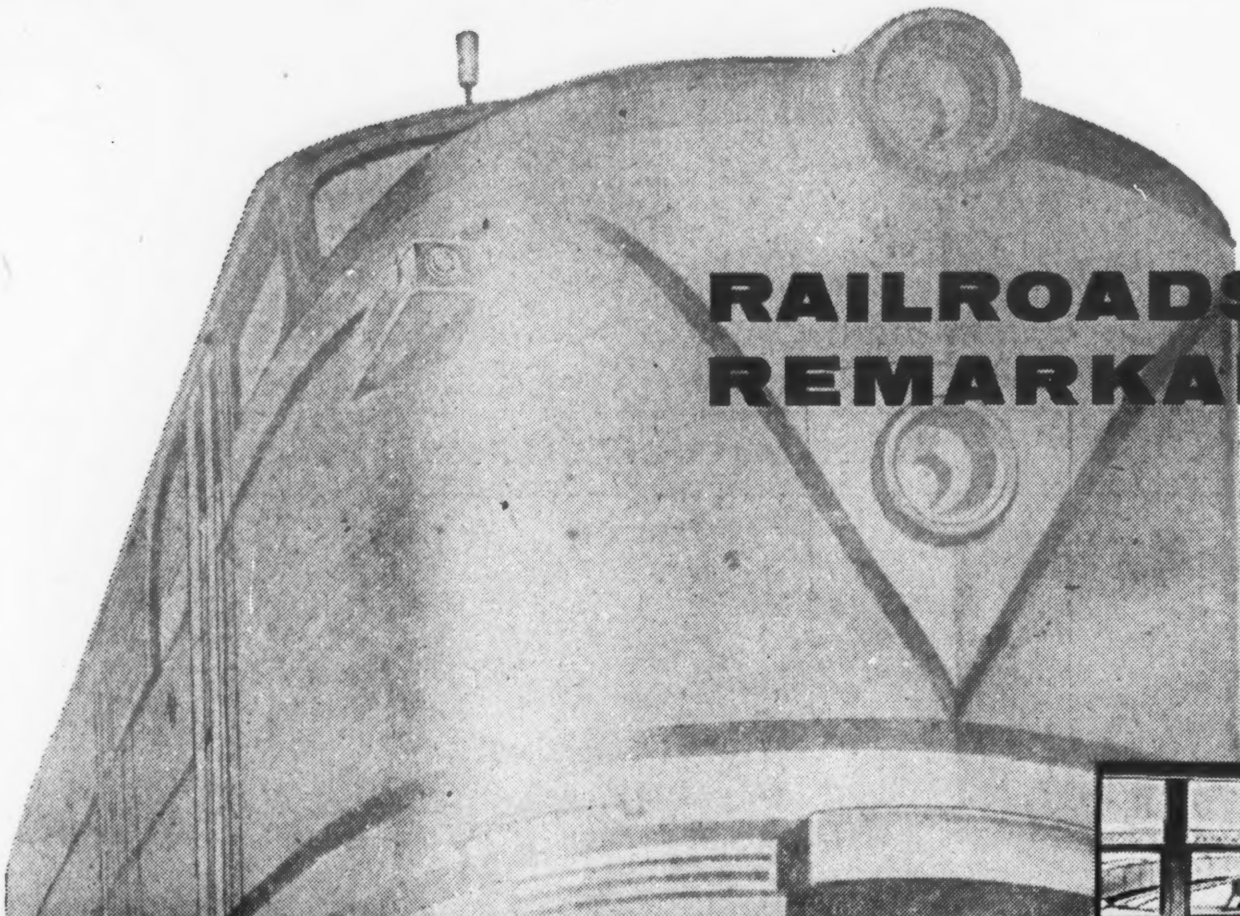

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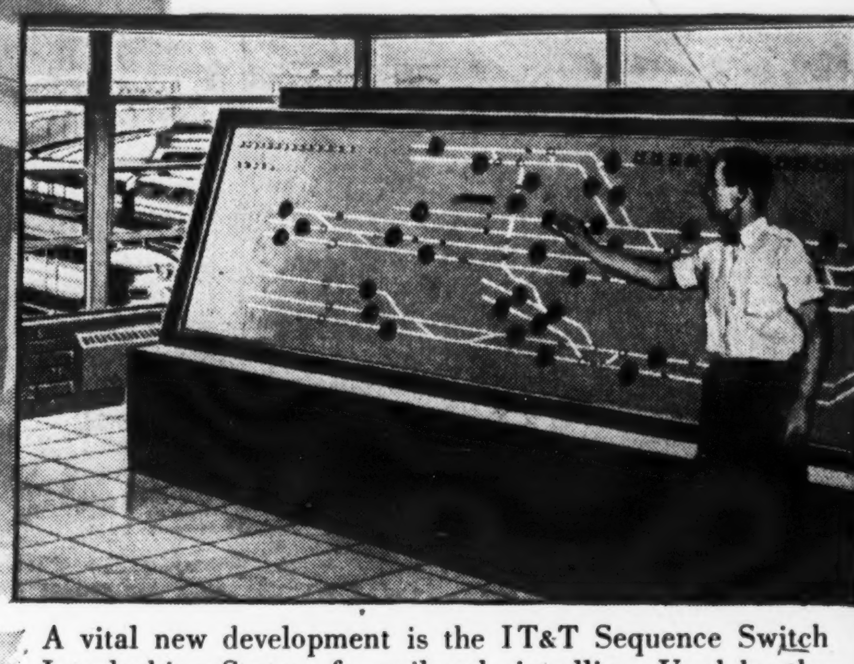

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Memo to SIGNAL Readers:

In this issue of SIGNAL, I am going to quote from a speech made at the 1953 Dayton AFCA Convention by Maj. Gen. Gordon A. Blake, USAF,--AFCA Vice President in charge of chapters and membership. It is particularly timely in connection with the overwhelming vote of the chapters in favor of the proposed addition of the word "electronics" to the name of the association.

"I would like to dwell a few moments on a vacuum which I think this association should fill. It is a vacuum created by the tremendous strides in the past decade in the common denominator of most of you—Communications and Electronics.

"Just consider for a moment the utter dependence of modern military operations on the products of the electronic art.

"In the Air Force, our air defense must have radar for warning and interceptor vectoring. The all weather interceptor is itself helpless to close with the enemy in bad weather, or at night, without its electronic fire control system. Our strategic bombers depend on radar bombing to the extent that this equipment, if out of commission, will ground the aircraft just as it will the engine. Air Force support of ground forces is managed over the battlefield through a complex, flexible, hard-hitting collection of radar and communications sets.

"In the Navy, there is a similar dependence on electronics to give purpose and direction to its naval aviation. The combat center in a carrier task force is a literal maze of 'black boxes.' Other elements of our fleet use electronics extensively for radar fire control, early warning against air attack, navigation and inter-ship communications.

"In the Army, radar fire control is vital, particularly for anti-aircraft. Split second battlefield communication permits ground forces to cash in on mechanized mobility. Even the most basic unit of all — the infantry squad — counts its walkie-talkie as a must to call on friendly artillery. . . .

"Now, what does this mean to the Armed Forces Communications Association? Consider the background and history of the AFCA. It is primarily in the communications and photographic fields. These are undeniably important, and I don't propose for one minute to de-emphasize them. But, what of radar, the electronic computer, and other electronic techniques so vital to modern military forces? Should not our AFCA grow with the times—or perhaps catch up with them—and embrace the whole gamut of the electronic art? This is the vacuum of which I spoke. If we don't fill it, what other voluntary association of civilian and military folk devoted to national defense can be counted on to do so?

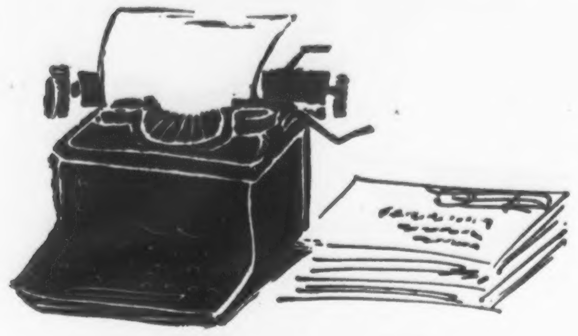
"There are a few specific points around which your thinking might resolve. For example: Both the name of the association and of its magazine are related to an era when electronics was not so widely used. Should they be changed? Some associations, similar to ours in purpose, use technical panels with great effectiveness. Should AFCA broaden its technical activities?

"Many fast-growing, relatively new areas in the electronics business are not represented among our active chapters—the burgeoning West Coast with its vital aircraft industry is a good example. What can we do to create strong, active chapters in these locations? . . .

"These are just a few ideas to chew on. Maybe it's biting off more than we can chew gracefully. But, this country is entering an electronic age—a threshold much like the mechanical age of a few decades ago. I'm sure that this electronic age deserves a dynamic association of its civilian and military people devoted to the principles in the charter of AFCA—and embracing *all* of the electronic art. Surely this is not 'too much to chew' for people like yourselves who have given us the electronic miracles of radar, television, split-second communications, and computers with the speed of light."

General Blake's talk covers the necessity for our intensified interest throughout the electronics field. What we need now is ACTION. Since the time of the Dayton Convention, nine new chapters and twenty new electronics group members have been chartered. But where are the hundreds of other electronics companies throughout the country? Do you know of one? They should be group members of AFCA. Do your part as a one-man membership committee--You, our SIGNAL readers.

The Editor



Our Readers Write

Lost—Three Zeros

DEAR SIR:

On page 68 of the July-August 1954 issue of SIGNAL, you have an article entitled "300th Network TV Station Linked to Bell System."

This article appears to be just a little on the conservative side. It states that 380 TV stations in the U. S. broadcast to an estimated potential audience of 109,000. I am sure that Mr. Joe Close, President of WKNY-TV, Kingston, New York will tell you that his station alone reaches a potential audience in excess of this number. That doesn't leave very many viewers for the other 379 stations!

Could it be that somebody has dropped three zeros?

JOSEPH J. BERHALTER
Colonel, SigC Res.
National Broadcasting Company, Inc.

(*Ed. No doubt about it, a few extra zeros—to make that number 109,000,-000—would make those other 379 stations a little happier. Thank you, Joe Berhalter.*)

Companies Accepted for AFCA Group Membership Since July 1, 1954

Aircraft Radio Corp., Boonton, New Jersey
Automatic Telephone & Electric Co., Ltd., London, England
Otis Elevator Co., Electronic Division, Brooklyn, New York
Radio Engineering Laboratories Corp., Long Island City, New York
Standard Telephone & Cables, Ltd., London, England

(Complete list of AFCA Group Members appears on page 50.)

490 new individual members from July 1 to September 1

ROTC Award Winners

DEAR SIR:

I would like to take this opportunity to thank you and your organization for the generosity you have shown by donating the prize which I received at the recent ceremony on the Plain at West Point. Your thoughtfulness is greatly appreciated and I believe that I may safely say that the feeling is shared by the authorities here.

LT. DONALD F. NEWNHAM, USA
U. S. Military Academy
Award Winner

DEAR SIR:

. . . thank you and the AFCA for the AFCA Honor Award and year's membership. I would appreciate information about the Chicago Chapter activities.

ROBERT A. MOORE
University of Alabama
Award Winner

Air Force Programming

DEAR SIR:

The article "USAF Programming for Fixed Communications-Electronics Facilities" gives a much clearer picture of this subject than we've seen heretofore. Please allow us to make reprints for distribution throughout our command.

WOJG ALLAN K. CHAPMAN, USAF
Hdqrs, 26th Air Division (Defense)
Roslyn Air Force Station

Tribute

DEAR SIR:

Would you kindly bring to the attention of SIGNAL'S readers the recent death of my old friend, Prof. I. E. Mouromtseff, famous radar expert and electronics inventor.

ALEXANDER A. KIRILOFF
Member New York Chapter, AFCA

(*Ed. Professor Mouromtseff, a fellow of the Institute of Radio Engineers, was the Professor of Physics at Upsala College from 1947. Prior to this, he had been with Westinghouse Electric Corp. for twenty years. A pioneer in ultra high frequency research, Professor Mouromtseff received the Westinghouse Order of Merit in 1947. It is with sympathy that we report his death.*)

Moving?

Send your new address to the Circulation Department, SIGNAL.

The Signal Corps Trans

by

Lt. Colonel W. M. Van Harlingen, SigC

H. L. Owens

Captain W. W. Hall, SigC

Signal Corps Engineering Laboratories

WHILE THE FLOOD OF PUBLICITY following the announcement of the invention of the transistor in 1948 and the concomitant high blood pressure engendered by "obvious" military applications injected a certain amount of excitement into military planning, it was soon recognized that transistor action, a most important discovery, was not immediately capable of being utilized in a device lending itself to mass production and general purpose application. For example, it was found that with the production techniques of that period reproductibility was difficult to achieve—a very serious limitation in any mass production venture.

After several years and much engineering and design work, improved production techniques were developed and a number of "point contact" types were brought to a stage suitable for large production. Even more important, however, was the development of the "junction" type with entirely new and important electrical characteristics.

Again applications engineers rose to welcome these much sought after devices, but this time, they felt, with more respect for what was real and what was only predicted. Nevertheless, in spite of this caution, predicted requirements turned out to be greater than actual needs; again in part due to new difficulties in transistor fabrication. For example, on shelf tests the diffusion of water vapor through plastic case materials and along the leads onto the germanium surface changed certain electrical characteristics. These troubles have been largely overcome, and today, it would appear, we stand on the brink of the long heralded application era of transistors.

There are four major program areas in which Signal Corps effort involving transistors is concentrated. They are:

(1) Conduct, in association with the Navy and Air Force, a research and development program directed toward the design of transistors meeting the peculiar requirements of the Armed Forces and which can be mass produced in the facilities mentioned in (3) below.

(2) Engage in an accelerated transistor application program to realize at the earliest date the promising advantages of transistors in military electronic equipment.

(3) Insure that production facilities and know-how are available in industry to provide the numbers and types of transistors needed by the military services.

(4) Expand, wherever possible, the area of solid state research in the realization that we have only scratched the surface insofar as knowledge and subsequent application of such knowledge is concerned. On this point we cannot forget the history of the electron tube triode and the many unpredicted advances which followed through several decades of study and exploitation of the laws of electron behavior in vacuum and gases.

As can readily be seen, all these objectives are closely interrelated, and progress in one depends on success in the other. This can best be illustrated with a chart typifying the research-development-application-production cycle. The upper left of Figure 1 shows the research and development laboratories where new devices are born. This building represents service laboratory and contractual effort with industry and universities. In the center is another such combined effort directed toward the application of the devices. In the upper right, the building shown represents American industry to which we look initially for limited production, to prove in the various types, as it were, and later, as firm requirements emerge, to be prepared for mass production.

You will note from the direction of the various arrows, the three contributing efforts to this program cannot be considered independently if time is of any essence. As is typical in the applied sciences, the initial results of research and development determine the applications' interest. The success in application and subsequent requirements determine production needs. The production process in turn imposes a specification, test, and evaluation work load on the development laboratory. Then finally,

Photo Courtesy
General Electric Company

r Program

he usefulness of the end product suggests the need for further research and development.

More specifically, we might illustrate a current situation. Certain limitations inherent in germanium semiconductors have dictated the necessity for further research in other promising materials, notably silicon, which might prove more suitable in transistors for many military purposes. The application program itself provides valuable information to those establishing design parameters for these new and as yet unborn transistors. New designs and the establishment of new specifications will in turn dictate changes in production facilities. As far as can be foreseen now, this cycle will repeat itself again and again, since research and development as it pertains to the military use of semi-conductor phenomena is only beginning, and we may expect continual advancement in the years ahead. For these reasons the entire transistor program is continually being re-evaluated and modified. Accordingly, the Signal Corps program must remain flexible if maximum progress as a function of effort and dollars is to be maintained.

Another point to be noted is that the Signal Corps does not think of the transistor so much as a replacement for electron tubes as a new device not only capable of circuit utilization similar to small tubes, but, far beyond that, potentially able to permit a type of electronic engineering either very difficult or even impossible with electron tubes of today. *To assume that the greatest potential of transistors is as a replacement for electron tubes would lead us to a costly re-engineering program probably at the expense of full utilization of the potential of this amazing new device.* In fact, it might be safely predicted that as

production of transistors increases, there may even be an increase in electron tubes required of the industry.

Still another point to be stressed is that the electron tube, and its myriads of applications in our present military effort, is the result of at least fifty years of effort in the field, with each decade making substantial contributions to the advancement of the art. In retrospect, we know how important these advances have been to our defense based on two World Wars and the recent Korean conflict. We have no reason to doubt that advances in the field of semi-conductors may be equally or even more important to our future military effort. Accordingly, the Signal Corps hopes to help accelerate transistor and other solid-state effort with an objective of achieving status within the next ten years comparable to that which required five decades for the electron tube program.

Before discussing the implications of transistors and reviewing the various aspects of the transistor research and development program, major classes of transistors will be identified and the current status of transistor development will be summarized. An artist's concept of a point contact and a junction transistor is shown in Figure 2. Point contact transistors are used primarily for switching applications and as oscillators and amplifiers at frequencies too high for satisfactory junction transistor performance. The junction transistor has important advantages over electron tubes and even over the point contact transistor, especially for low frequency applications due to its high gain and low power consumption. The junction transistor is sometimes further classified as of either PNP or NPN type. In general, the same considerations apply to both types and the only obvious difference is that opposite battery voltages are employed.

A number of commercial types of germanium transistors have been announced as illustrated in Figure 3. The numbers in parentheses indicate the approximate number of types of units of a particular class which are being offered commercially. Approximately the same number of types of point contact and junction transistors have been announced. However, the increase in the number of types of junction units has been at least twice that for point contact units within the past year. In all cases, the point contact transistors indicated are low power devices (less than 200 milliwatts). An especially important characteristic of the point contact unit is its suitability for switching circuits, such as are employed in computer circuits. The division between low frequency and high frequency has been established arbitrarily at three megacycles. The dearth of high frequency units of both types is apparent.

Experimental junction transistors with power dissipation ratings greater than 200 milliwatts are under development. All commercial type junction transistors now available, however, have low power dissipation ratings. Not only are the present junction transistors low power devices, but also almost all types are limited in frequency response to less than three megacycles.

In summary, Figure 3 indicates that commercial transistors have not been developed in these categories: High power, high frequency, and junction transistors for switching applications.

Advantages of Transistors

Military electronic equipment employing transistors is expected to enable the user to enjoy important advantages. In the following list, two categories are enumerated. The immediate advantages are those which are considered well-established and there is little reason to question their realization. The long range advantages are those which appear to be possible with further transistor development.

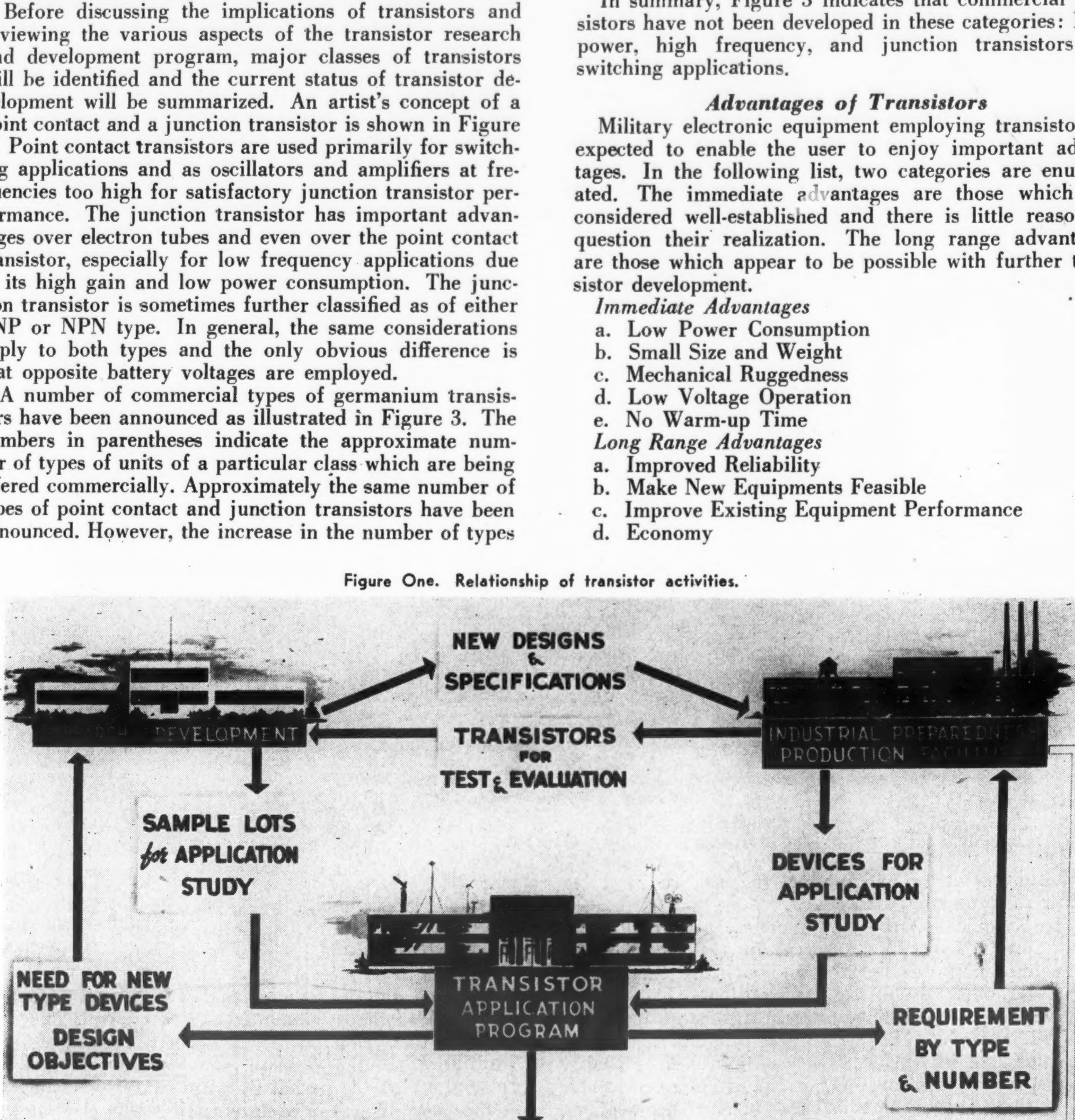
Immediate Advantages

a. Low Power Consumption
b. Small Size and Weight
c. Mechanical Ruggedness
d. Low Voltage Operation
e. No Warm-up Time

Long Range Advantages

a. Improved Reliability
b. Make New Equipments Feasible
c. Improve Existing Equipment Performance
d. Economy

Figure One. Relationship of transistor activities.



The low power consumption of transistor circuits is a property which has been widely publicized. It is quite common for transistors to perform in practical circuits with 1/10th of the power that would be consumed by an equivalent vacuum tube circuit. In exceptional cases, the power saving might be as great as one hundred to one.

Through the reduction of battery power requirements, equipment of smaller size and weight can be developed. Additional factors contributing to still further reduction in the size and weight of equipment are the size of the transistors themselves and the simplification of circuits possible through their use.

Because of its small size, one might expect the transistor to be very rugged mechanically. This has been found to be the case, especially for junction units, since they employ no pressure contacts or critical mechanical spacings. There is good evidence that ruggedness is so much an intrinsic property of transistors that transistors suitable in this respect for all military field applications will impose no unusual design complexities.

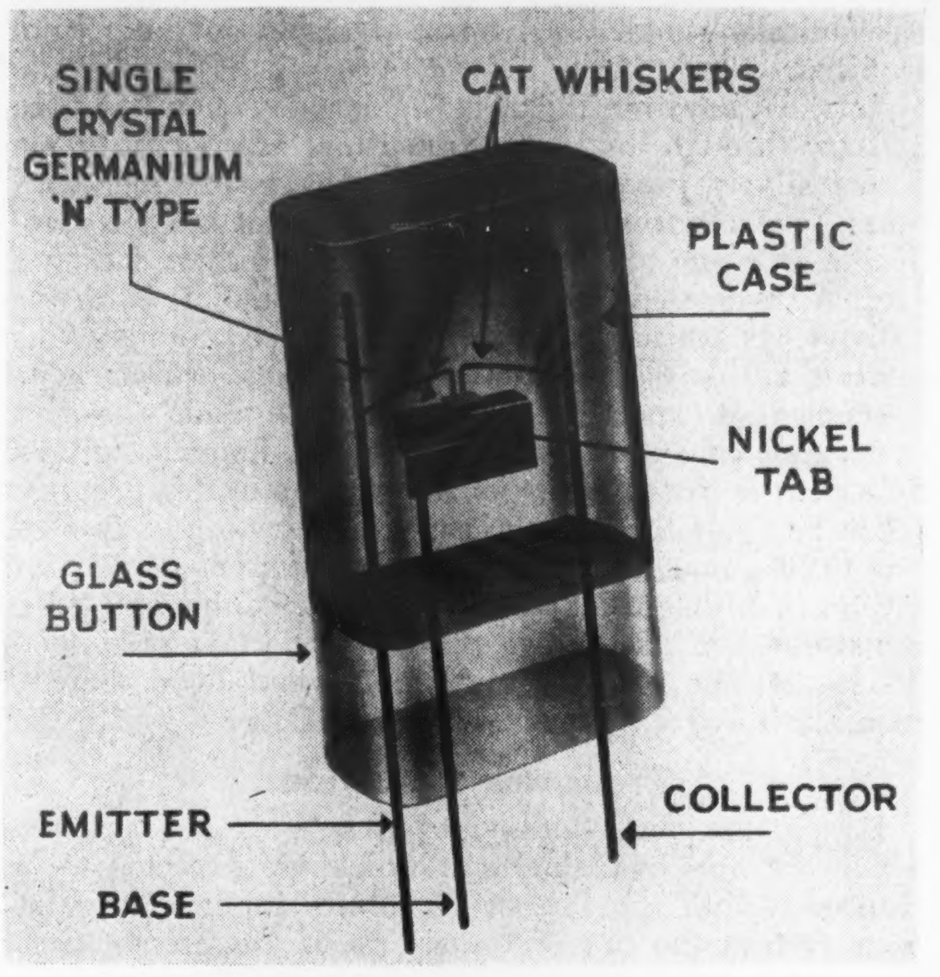
The operation of electronic equipment from low voltage power supplies has a number of important implications. One advantage is that the equipment may be operated directly from a 24 volt vehicular battery and eliminate the need for a high voltage supply. Further, portable equipment, where size and weight are at a premium, use small batteries which are more efficient at low voltages than at high voltages. Low voltage batteries are also cheaper.

In field use the military services require a number of types of equipment to be in a constant state of readiness. Due to the appreciable warmup time of vacuum tubes, it is often common practice to leave the equipment, or at least the tube filaments, "on" for long periods of time. Not only does this consume a large amount of battery power, but it also tends to age the equipment. Since transistors operate instantaneously the equipment may be turned off when not in use, thereby saving power which would be required during stand-by periods.

Of all the advantages expected through the use of transistors, improved reliability is one of the most important. Studies to date have produced evidence that some transistors have very long life. They would be expected to last on the shelf, or in operation, for years and years. Unfortunately, other transistors have had short life. Many of the causes have been determined but until all factors are understood and brought under control, reliability cannot be regarded as an accomplished fact. The inherent ruggedness of the transistor and the fact that none of the materials in transistors are consumed during use supports the view that transistors are potentially capable of greater life and reliability than electron tubes.

Field experience with appreciable numbers of transistors is presently limited to the hearing aid industry. Despite early adverse publicity regarding reliability of transistors in hearing aids, improvements in the fabrication of transistors have greatly improved reliability. It is now reported that more than twenty companies are manufacturing hearing aids using transistors and that the field failure rate is at least as good as with electron tubes. Considering the short time during which this progress has been achieved, substantial additional improvements are confidently predicted.

The advantage of making new equipments feasible is not really an advantage in itself but rather a reminder that the substantial differences between transistors and those electronic transducers previously available may make possible entirely new types of electronic apparatus. Study by the military is needed here because tactical needs must be examined. Transistor computers are but an example of the type of equipment which might now be developed whereas vacuum tube models have not been feasible due to excessive size, weight, or power consumption.



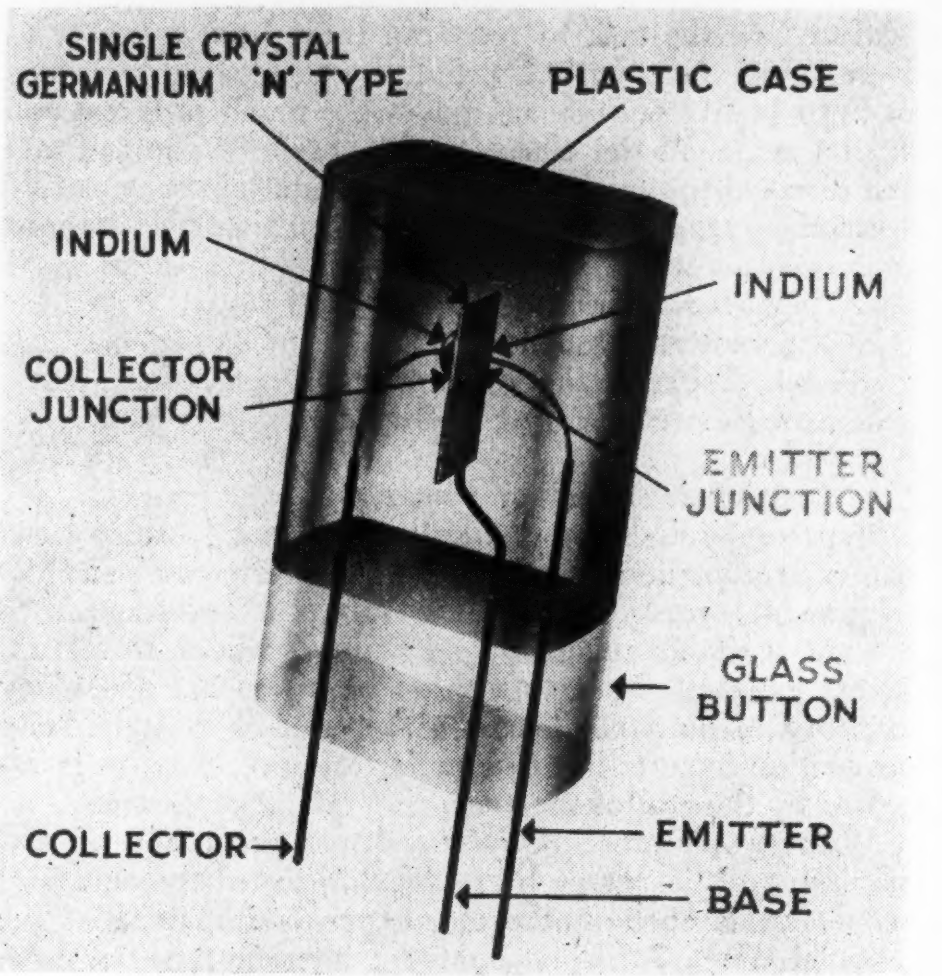


Figure Two. The upper diagram shows the make-up of a Point Contact, N type, transistor. In the lower diagram, a junction, PNP type, transistor is illustrated.

Economy

For equivalent performance there is good reason to believe that equipment using transistors may be cheaper to produce, to operate, and to maintain than equivalent vacuum tube models. Insofar as the present cost of transistors is concerned, prices between five and ten dollars are typical while a few types of units cost as much as thirty dollars. Improved and cheaper methods of manufacture are being found; with increased production, prices in the three to five dollar range should be reached without difficulty. Ultimately, through mechanization of the manufacturing processes and volume production, transistors should be cheaper than tubes because the device is

mechanically simpler and fewer assembly operations are required.

Actually, however, the most important economies to the military through the use of transistors are not to be expected simply because transistors may be cheaper than tubes. The electronics industry in this country is producing at a rate of between five and six billion dollars a year. An estimated forty per cent of this output is for the military. If transistors offer important advantages, the services are developing and manufacturing equipment at a tremendous expense that could soon be made obsolete; in fact, at a monthly cost of about two hundred million dollars. It is clear that important savings in this program might be made through the early introduction of transistors. Then, too, the cost of field operation is often far greater than the initial cost of electronic equipment. Here, transistors are expected to provide important economies due to greater equipment reliability and lower battery requirements.

Transistor Limitations

Despite the many attractive advantages of transistors which are now available, and which are expected to be realized within the forseeable future, important limitations restrict the use of transistors at the present time. Transistor research and development programs are concentrated on the task of reducing these limitations or of overcoming them entirely. Sufficient progress has been made to justify confidence that while much progress can still be made, in the absence of a carefully planned and well directed program some of the limitations may not be overcome for many years. Major transistor limitations are:

a. Unproven Reliability
b. Temperature Dependence
c. Lack of Production Uniformity
d. Low Power Handling Ability
e. Noise
f. Restricted Frequency Range

Unproven reliability has been listed not because transistors are not now satisfactory for experimental and developmental work but because sufficient information is not yet available regarding reliability in field use. Transistors capable of meeting these requirements are likely to prove to be a challenge to the transistor design and production experts but production of several types is expected by the end of the year.

Virtually all present-day transistors are made of germanium and the temperature dependence of the electrical properties is such that performance is impaired at the elevated temperatures encountered in some types of service. Progress has been made in designing germanium transistors with improved temperature characteristics and operation is feasible to 160°F. in noncritical applications. More commonly, operation above 130°F. is not feasible. Further progress is expected but a more promising solution is to develop transistors of another semi-conductor material. Because of its slightly different pertinent properties, silicon is being studied and appears potentially capable of satisfactory high temperature operation. Other materials now being studied may also prove to be superior to germanium.

Production uniformity of germanium transistors does not appear to be a basic limitation. The production experience to date has shown that better germanium process control as well as simpler and more economical production techniques can improve yields and lower production costs. When the junction transistor was announced, some production men regarded the difficulties of mass production as almost insurmountable. Now some of these same production men regard the junction transistor as cheaper to manufacture than the point contact unit!

Existing commercial transistors have power dissipation rating limits of 50 to 150 milliwatts. Higher power transistors are being developed. A small number of experimental transistors have been tested in the Signal Corps laboratories at power dissipation levels in excess of three watts. In *principle,* silicon power transistors should be capable of delivering even greater powers.

Though transistors have a satisfactorily low noise figure for use in many applications, they are usually more noisy than vacuum tubes. The mechanisms responsible for noise in transistors are not well understood. In the absence of proof that the noise *must* be present there is hope that it can be substantially reduced. With better processing controls the noise in junction transistors is being slowly reduced and the noise figure of the best units produced is now approaching vacuum tube performance.

Transistors are capable of operating over a sufficiently wide frequency range for use in wire communications and in many control-type circuits. A limited number of the types of units are satisfactory at radio frequencies. Within the last year good progress has been made in improving the frequency response of junction transistors and there seems to be little doubt that highly efficient transistor intermediate frequency amplifiers for radio receivers and similar applications can be built with improved junction transistors now under development.

Steps in Transistor Development

To pursue transistor research, development and production effectively it is necessary to conduct a well coordinated program embracing not only these activities but the circuit design and equipment activities as well. Theoretical and experimental investigations contribute to the success of each and every part of the transistor research and development program, and it is instructive to follow the development processes for an item such as a germanium junction transistor.

First, the theoretical and experimental evidence must be sufficient to warrant a conclusion that the material has suitable electrical and mechanical properties for use in a transistor. This information is derived from studies of solid state physics. Having chosen the material, germanium in this example, it is necessary to purify it to an extraordinary degree. Germanium suitable for use in transistors is usually purified to the extent that only one impurity atom remains for each one hundred million atoms of germanium. An idea of this order of purity may be obtained from a comparison with the term "chemically pure". The chemist may consider a material to be chemically pure if there is no more than one part of impurity for each hundred parts of the material.

Pure germanium must next be grown into a large single crystal whose electrical properties are accurately controlled. Slices or wafers of germanium cut from the single crystal material may be used to study the formation of "barriers" or junctions such as are employed in rectifiers. Only after the theoretical and experimental work on the formation of suitable barriers is completed is it feasible to proceed with the actual transistor design and fabrication.

The solution of a single transistor development problem may be applicable to a variety of types of units. For example, once a suitable means of encapsulating a particular design has been developed, it may be employed in similar designs with relative ease. This illustration is not an academic one. In fact, a very serious problem in transistor development has proved to be the development of moisture resistant packages. These packages, when fully developed, are expected to be used for a wide variety of types of units.

As a part of the transistor development program, stand-

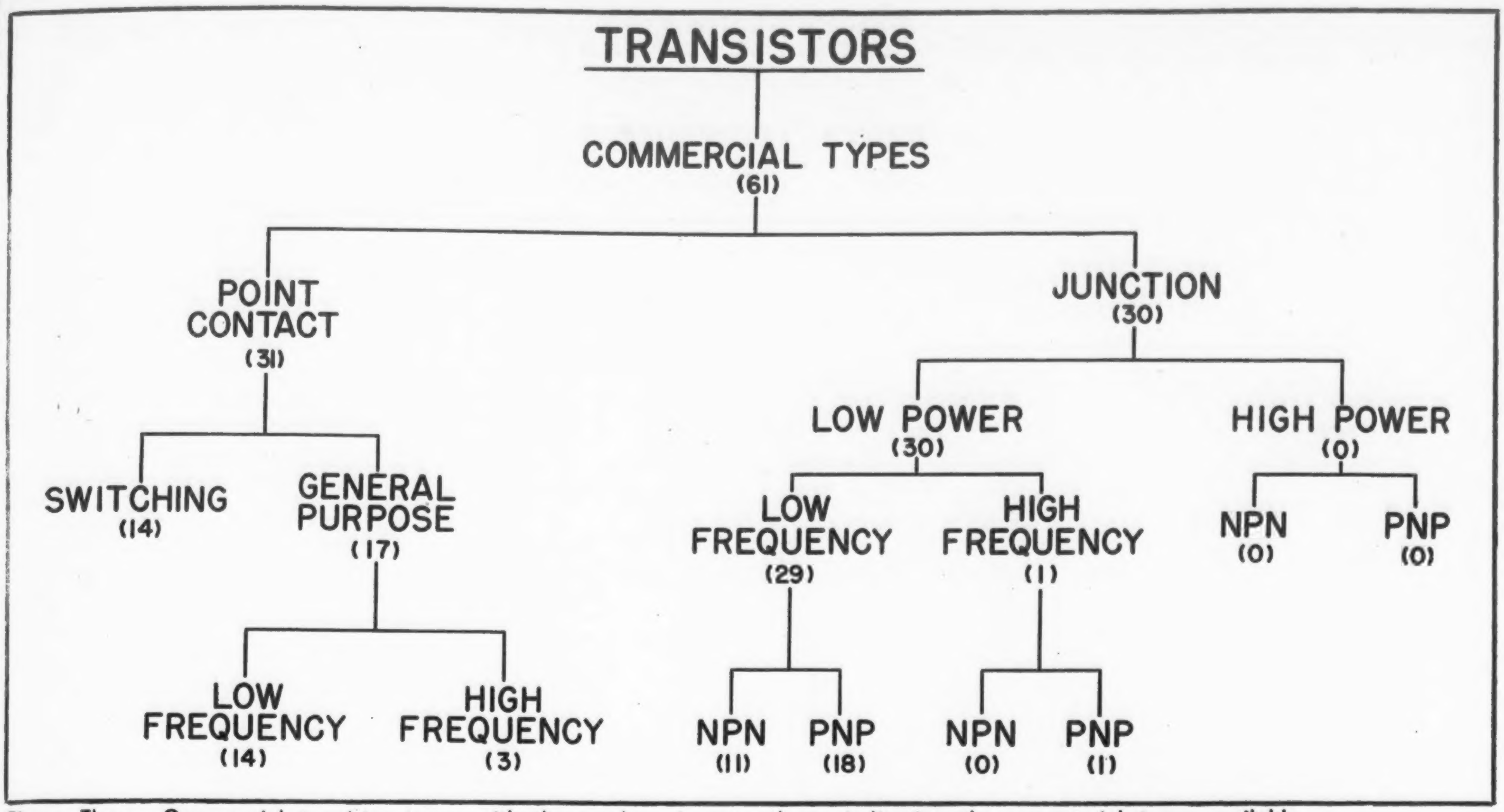


Figure Three. Commercial transistor types, with the numbers in parentheses indicating the commercial types available.

ardization must be achieved. In Figure 2, illustrating the construction of transistors, a lead arrangement was shown which was originally proposed by the Signal Corps more than a year and a half ago and has become an industry standard. The rapid development of the transistor has outdistanced the development of definitions, methods of tests and standard specifications for transistors. An intensive effort sponsored by the Signal Corps between January and September of 1953 resulted in the writing of a military standard for transistors. This standard or basic section, as it is commonly referred to, provides the necessary definitions, methods of tests, and inspection instructions necessary for the preparation of specification sheets detailing the electrical and mechanical characteristics of a particular type of transistor. This specification is now being used by each of the Military Services. Work on the preparation of specification sheets for specific types of transistors is underway and it is expected that this program will keep apace of new transistor developments. These specifications are of considerable importance because they establish for the first time a clear and complete description of the military requirements.

Circuit studies, as well as specific equipment development, complete the cycle in the development and application of the transistor. Needless to say throughout the whole process new problems and new objectives are constantly being generated.

Application of Transistors to Signal Corps Equipment

When limited quantities of the first transistors became available for military use in 1951, they were used for distribution to engineers within the Signal Corps laboratories to acquaint them with this new device. Finally by mid-1952, sufficient numbers of several types were available to supply to contractors and a contractual program was initiated.

In order to take advantage of contracts already underway, in June of 1952 all contracts were reviewed to determine which might lead themselves to transistor application work. Modifications were offered contractors holding applicable contracts which encouraged them to use Government furnished transistors in the development of the item called for. The only requirement under this so called "encouragement clause" was that the contractor report the results of his work, but equipment specifications remained unchanged. Beyond the concrete results which have demonstrated the usefulness of transistors in various equipments, these encouragement clauses have acted to provide a source of contractors, versed in transistor circuitry, to whom future application contracts might be let.

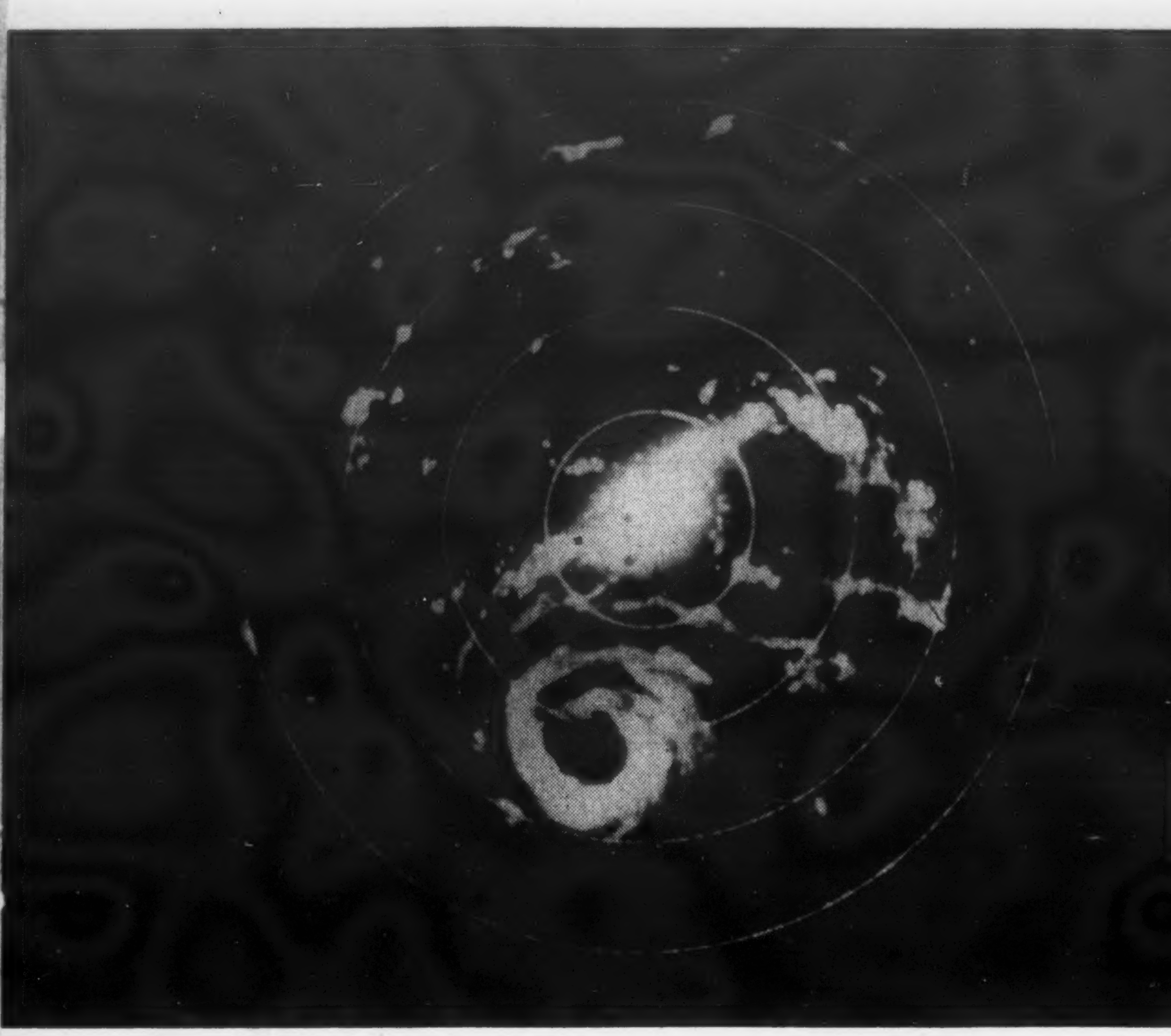
Application work has been directed toward nearly all classes of equipment which show promise, bearing in mind the limitations in frequency and power which they obtain. There are several basic circuitry studies not related to specific end items but providing valuable and timely information to those concerned with equipment design. Several projects are concerned with the design of separate components such as counters, amplifiers, oscillators and general computer circuitry which can be utilized in many types of equipment. Finally, there are contracts for the design of complete end items covering a large number of uses: Field wire repeaters, telephone and teletype terminal equipment, radio receivers, and radio instruments, and the list is constantly increasing. Mechanical or temperature limitations have not been allowed to restrict the choice of applications since it has been assumed that such limitations will be overcome by further device research and development.

The Internal SCEL Program

The internal application program at the Signal Corps Engineering Laboratories covers an even wider range of application studies which have, in many cases, provided the basis for the development contracts. An important aspect of the internal transistor application program has been the training of engineering personnel in the use of this new device. As a result, personnel from contractors, particularly the smaller concerns, have come to the Signal Corps Engineering Laboratories and received valuable information and guidance contributing greatly to their respective projects.

The application program has progressed sufficiently to enable our engineers to arrive at significant conclusions

(*Continued on page* 78, *col.* 1)



A radar picture of a hurricane as viewed by a radar operator on Dr. Page's plan position indicator.

NRL

by Charles DeVore

"birthplace of radar"

TRADITIONALLY KNOWN AS THE "SILENT SERVICE", the Navy does not go in for billboards. If it did, it might well have one at the Naval Research Laboratory in Washington, D. C., which would identify that activity as "The Birthplace of Radar".

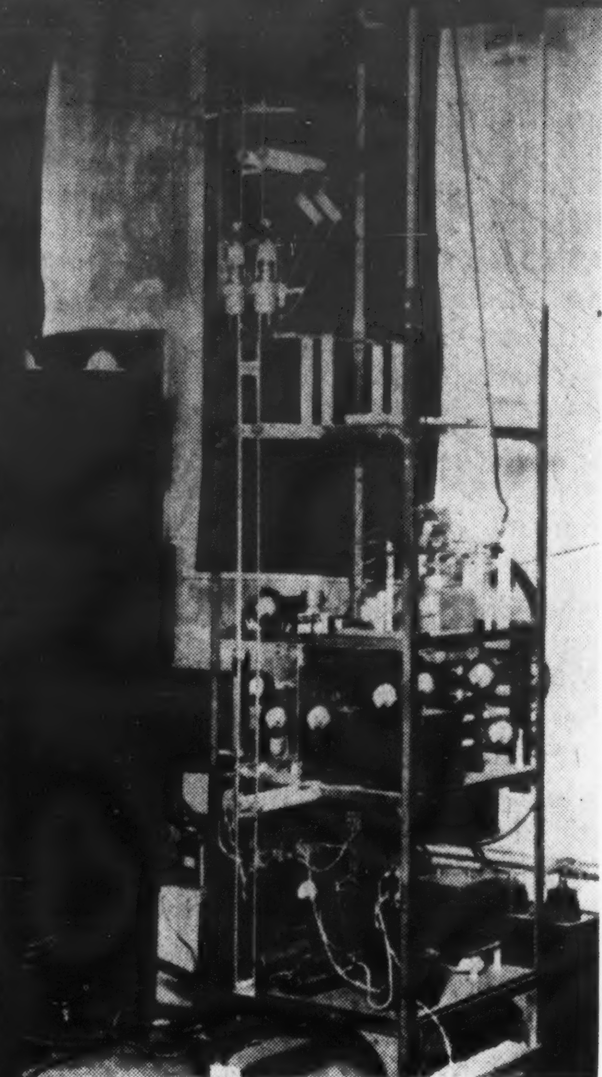
The Navy got additional Governmental recognition for that claim on April 27 this year when Dr. Robert M. Page, NRL's associate director of research for electronics, was awarded another basic radar patent. This was U. S. Patent 2,677,127, issued to Dr. Page for his invention of the radar mapping device known as the *plan position indicator*, or P.P.I. This latest patent is one of a number which cover basic developments in radar, all of which resulted from the work of Dr. Page and his associates at the Naval Research Laboratory.

The P.P.I., standard equipment on most commercial and military radar sets today, gives the radar operator a complete picture of the area searched or "swept" by his set on a cathode-ray oscilloscope, or TV-picture tube. During the war, this device enabled gunners and bombers to hit unseen targets, enemy ships and aircraft to be detected, and our own ships to be navigated in spite of "rain, snow, or gloom of night" as well as impenetrable fog. Today, this same device aids in landing airplanes at fog-shrouded airports, is used as a navigation device aboard such varied commercial craft as trans-oceanic liners, lake steamers, tugs, ferry-boats, and fishing schooners, and gives meteorologists a tool with which to forecast and track hurricanes.

The issue of this latest patent serves to mark, unofficially, two radar anniversaries for the Navy. Fifteen years ago, the first naval radar set, installed aboard the battleship USS NEW YORK, was given extensive sea trials. This set was officially designated as the XAF and resulted from the development work by Dr. Page and his associates at the Naval Research Laboratory. Twenty years ago, 1934, marks the beginning of pulse radar development and the first pulse radar echoes.

The Navy's credit for the development of radar is traced back to the discovery in 1922 by Dr. A. Hoyt Taylor (now retired) and Leo C. Young (now consultant to NRL's Radio Division) that radio signals were reflected from steel buildings and metal objects, including ships. In 1930, Mr. L. A. Hyland (now with Bendix Aviation Corporation) discovered at NRL that radio signals were similarly reflected by aircraft in flight.

In 1934, it was proposed by Leo Young that these discovered phenomena be employed in a pulse system for measuring distance to, and direction of reflecting objects. Following this proposal, Dr. Page (who



0-mc radar transmitter with duplexer (2-rod rame diagonally at top) installed at the Naval Research Laboratory building in December, 1936.

had joined the Laboratory in 1927), working under Mr. Young's supervision on various problems, conceived a number of ideas which resulted in the start of the actual development of pulse radar.

The first experimental pulse radar system for detection of aircraft was completed and tested in the Naval Research Laboratory in December of 1934. This test, which operated at 60 megacycles, successfully indicated the presence of aircraft within a few miles' range, but did not have adequate range resolution to be of practical value.

Dr. Page then began work on improving the range resolution, reducing the minimum possible range, increasing the maximum range, and increasing the angular directivity. At that time, there existed no wartime urgency to make these improvements quickly, and the economic depression was still affecting research, so Dr. Page worked virtually alone for the first one and a half years. However, in the Spring of 1936 echoes were being received to ranges of 25 miles with range resolutions of 500 yards.

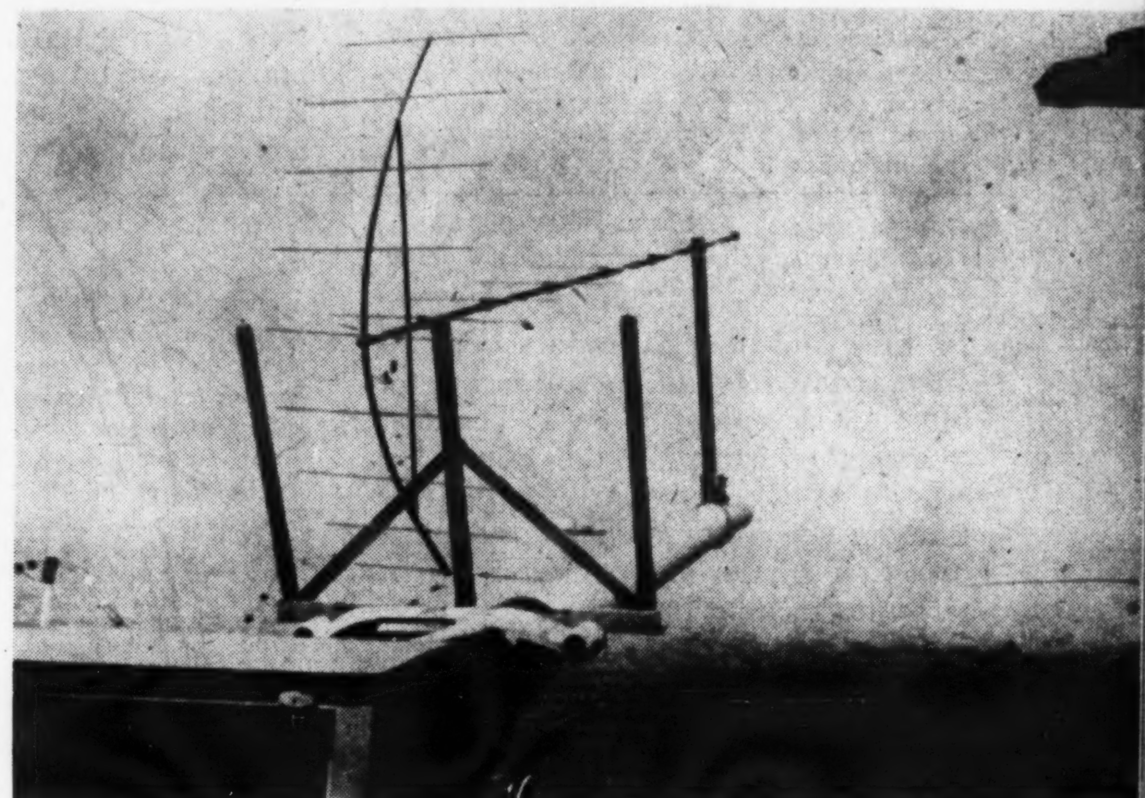
During the summer of 1936, a radar set was developed in the 200-mc band which operated both transmitter and receiver on the same antenna through a duplexing system which has since become common to all radar, and resulted from the combined work of Dr. Page and Leo Young. In the fall of that year, that and other radar sets built in the Laboratory were consistently getting strong echo signals from small observation planes (Dahlgren "spotting" planes) at ranges up to 40 miles.

The invention of the duplexer spurred interest in the new development for shipboard operations, and this 200-mc radar was installed aboard the destroyer USS LEARY and taken down the Chesapeake Bay. The single antenna was crudely mounted on a four-inch gun, but detected aircraft out to 17 miles and navigation buoys at 3 to 4 miles, in a horizontal direction. (The limited range on airplanes was due in part to the use of a smaller antenna necessitated by installation on a destroyer.)

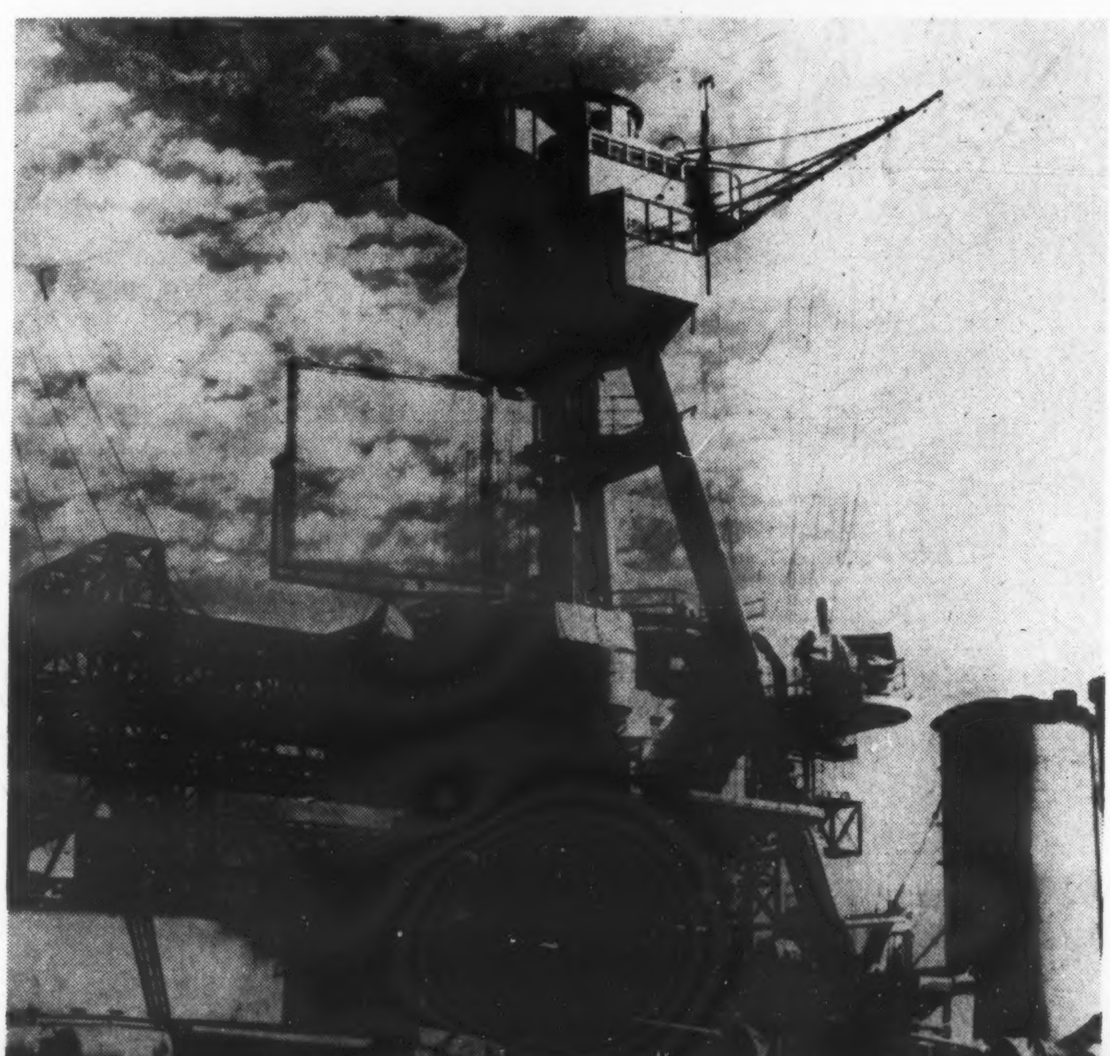
During the summer of 1938, the first service radar designed and built for marine use was built at NRL and installed on the battleship USS NEW YORK for tests in the naval maneuvers scheduled for early 1939 in the Caribbean area. This set, which was officially designated as the XAF, operated at 200 mc, detected other shipping at ranges of 9 to 12 miles, and airplanes out to 85 miles, with a range resolution of 275 yards. This set established a record of 72 days and nights of continuous operation without a shut-down and without a tube failure, while under way at sea. It is believed that this record for reliability has never since been equalled!

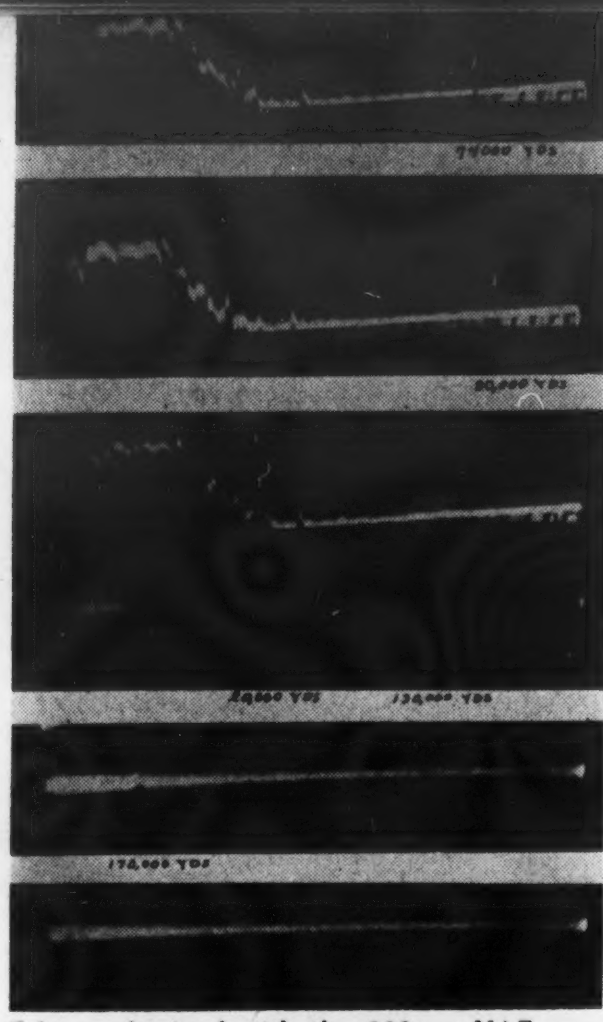
As an immediate result of these sea trials, the XAF was sent to RCA and six identical equipments were procured for installation in the Fleet. These six sets were later followed by

The first 200-mc radar antenna installed on the USS LEARY, in April, 1937. This antenna is a six-director with parabolic reflector mounted on a 5-inch gun. A second antenna, used two weeks later, was a curtain array with reflector, mounted on the same gun, in place of the Yagi.



This XAF radar installation aboard the USS YORK was tested on naval maneuvers in early 1939 in the Caribbean area. Trials of this set "sold" radar to the Navy.





Echoes obtained with the 200-mc XAF prototype set. On this test, target was observed out to 97 miles in September, 1938. The distances from the target, a small two seater plane at 20,000 feet altitude, are: (top to bottom) 74,000 yards; 80,000 yards; 120,000 yards; 130,000 yards; 170,000 yards; and 180,000 yards.

14 more and these 20 radars were the only radar sets in operation in the Fleet on December 7, 1941. These 20 sets made history in the South Pacific in 1942, particularly in the first raid on the Marshall Islands and in directing carrier-based fighters to intercept attacking bombers.

One example of the kind of history they made is this account of their use for fighter-direction aboard a Naval carrier. Thanks to the XAF, the vectored planes destroyed 17 out of 18 Japanese bombers! The XAF picked up one wave of nine bombers and the carrier's fighters took off on interception. They shot down all nine planes, before the bombers could release their loads. Before the planes could return to their carrier, the XAF had picked up a second wave of nine bombers approaching and the carrier radioed the information to the fighters still in the air. Eight of these planes were destroyed, leaving one to return to tell the story of a new American "mystery weapon".

Experience with this radar on the USS NEW YORK trials demonstrated the need for a different type of presentation, a type now called Plan Position Indication, or P.P.I., which is used on all marine radar today. Dr. Page started the development of P.P.I. in the spring of 1939; it was successfully operated in the Laboratory in the spring and summer of 1940. This type of presentation was adapted to marine radar equipments then installed in the Fleet and was incorporated into all new designs.

By the beginning of 1941, the Navy's radar program had reached the point where development for commercial production of equipments for use in the Fleet was well underway. An extensive program of research and development had been embarked upon, utilizing not only existing Government laboratories, but also the research laboratories and personnel of the major electronic companies in this country, including General Electric, Westinghouse, Bell Telephone Laboratories, Raytheon and RCA. These companies were not only carrying on research, but were also undertaking commercial production, a task which at that time, in effect, consisted of laboratory manufacture, since the building of radar sets could not yet be adapted to assembly line methods of production.

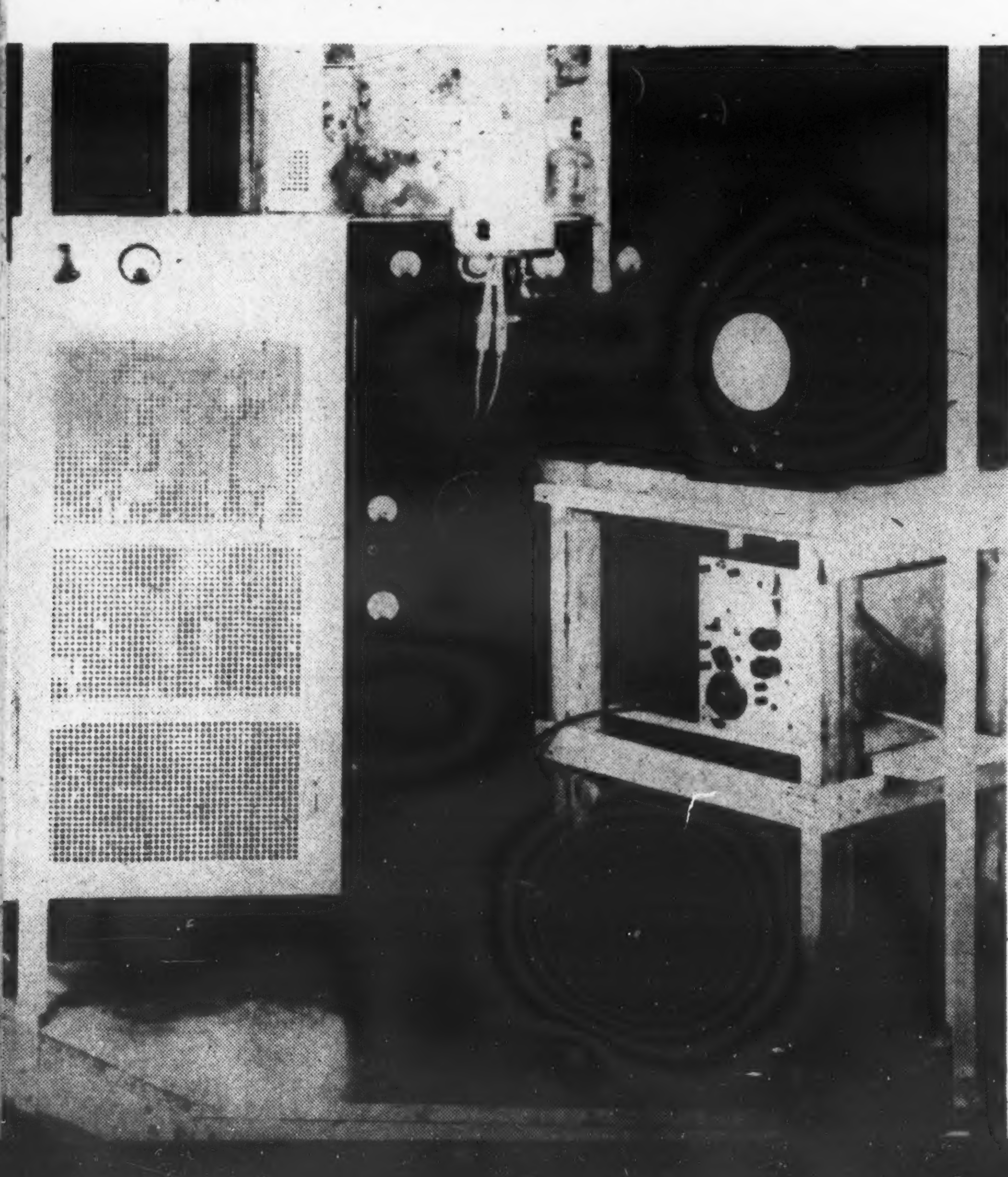
The contributions by Naval Research Laboratory scientists to the development of radar were officially recognized in 1946, when 11 of the

Dr. Robert M. Page, associate director of research for electronics at NRL, was congratulated by Rear Admiral F. R. Furth, Chief of Naval Research, when Dr. Page received U. S. Patent 2,677,127 on April 27, 1954 for his invention of the radar mapping device known as the plan position indicator.

men (including Dr. Page and Leo Young) received the Presidential Certificate of Merit for their contributions to radar development. Seven of these 11 men are still at NRL today.

Radar development continues today. It has reached the stage where relatively inexpensive commercial radar can pinpoint an orange crate floating in the water at distances of several miles and can safely guide an ocean liner through crowded waters in the heaviest fog.

In the Laboratory, range resolution has been pushed to the order of less than 10 feet and angle resolution to less than 1 degree. As for simplicity, Dr. Page points out that a modern commercial marine radar set is no more complex than a conventional television receiver. The parts from which it is made, he admits, remain somewhat more expensive than in a television receiver, because there are fewer radar sets than television receivers.



Laboratory model of a high-power 200-mc radar, February, 1938. This model was "frozen" for the XAF design. The transmitter is on the left in the photograph with the receiver in the background. On the right, top to bottom, is the rectangular (two-line) time base generator, indicator, and synchronizing oscillator, all mounted on an octagonal platform which rotates with the antenna. The duplexer projects into the chimney-like box on top of the transmitter. This equipment followed a small observation plane to a range of 97 miles (see echo results above).

PHOTOGRAMMETRY

and

Communication Techniques

by Morris W. Thompson

**Staff Engineer, Photogrammetry
U. S. Geological Survey**

**Chairman,
Technical Information Committee
American Society of Photogrammetry**

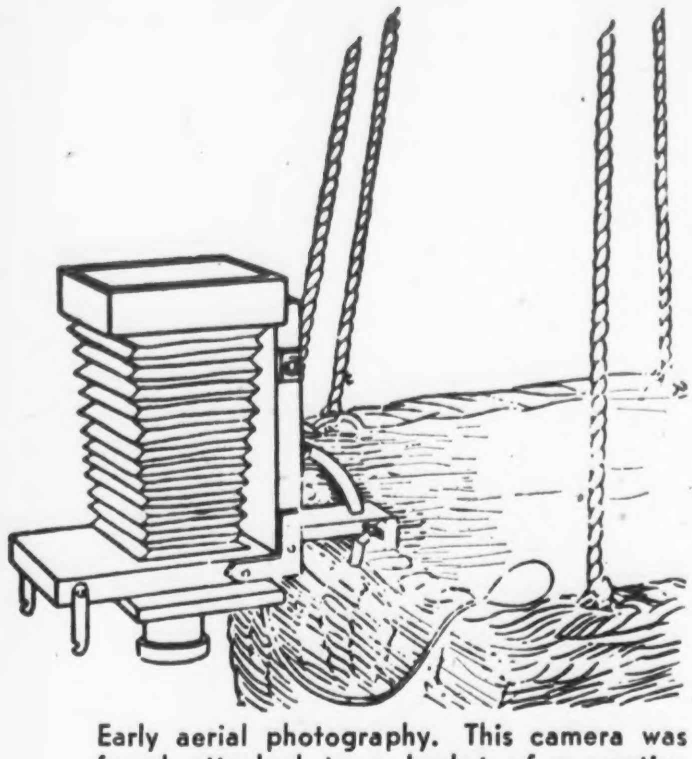
In May 1862, a captive balloon bearing the insignia of the Union Army soared in seeming innocence above the embattled forces deployed before Richmond. The Confederate command, wondering what the Yankees were up to, doubtless guessed that it was a means for visual reconnaissance that could do the South no great harm. Had the Confederates realized just how penetrating a reconnaissance activity was in progress, they might well have been considerably alarmed; for this was the first use of aerial photogrammetry recorded in military annals. Here is how Lt. Henry A. Reed, West Point professor, describes the situation in his book, "Photography Applied to Surveying," published in 1888:

The Union Army succeeded in photographing on a single plate all the countryside between Richmond and Manchester to the west and the Chickahominy to the east . . . Prints were made from the negatives; one of these remained in the hands of the commanding officer and the other was delivered to the aeronautical unit. Rectangles had been drawn on both of them in equal number and disposition and reference letters had been inscribed on them; and after the subsequent ascensions, the photographs permitted the aeronautical unit to give information on all events of any importance which took place in each rectangle, information which, in several instances, proved very useful.

Photogrammetry, *the science of obtaining reliable measurements by photography*, had its beginning ten years before the Richmond activity described above, when a French Army officer, Aime Laussedat, produced the first maps ever made from photographs. In the ensuing century, the science of photogrammetry has advanced from the crude applications of the early days to a major engineering technique capable of producing measurements of the utmost precision.

Photogrammetry in the Modern World

The principal use of photogrammetry at present is in map making, but other applications are becoming increasingly important. Some of the other fields in which photogrammetry is an important tool are: exploration, military reconnaissance, geology, forestry, agriculture, urban planning,



Early aerial photography. This camera was found attached to a basket of a captive balloon during the Civil War period. (Reproduced by permission from "Photography Applied to Surveying," John Wiley & Sons, 1888.)

cadastral problems, and medicine. The general approach to photogrammetric problems is the same, regardless of the purpose of the work.

By virtue of its role as the key technique in modern map making, photogrammetry exerts a profound, if indirect, influence on our world today. Good topographic maps are an indispensable prerequisite to the inventory, development, and efficient use of our natural resources. Aeronautical and hydrographic charts provide the necessary road maps for the skies and the seas. The location and construction of bridges, dams, highways, factories, public utilities, and many other improvements affecting our civilian economy can be properly planned only if sound planning maps are available. Reliable military maps are a high-priority need as a basis for planning strategy and tactics. All of these kinds of maps can be made more speedily by photogrammetric methods; indeed, our map making would be hopelessly behind the need if we had to rely on the field surveying methods of a generation ago.

Although photogrammetry is 100 years old, it is still new and modern in the sense of wholesale application to the mapping field. For it was only under the urgent necessities of World War II that photogrammetry replaced field surveying as the basic procedure for map making.

Some Problems of Photogrammetry

Most of the aerial photographs used today for map making purposes are vertical photographs. A vertical photograph is one taken with the optical axis of the camera held as nearly vertical as possible so that the plane of the photograph is nearly parallel to the earth's surface. If the surface of the earth were perfectly flat and if the plane of the photograph were held exactly parallel to the earth's surface, the photograph would be a true map having a uniform scale. However, the difference of elevation between various objects in the terrain photographed causes relative displacements of the images, depending on the relief of each object. In addition, the photograph is invariably tilted to some degree because of the lack of a means of maintaining the camera in a truly vertical position; the photograph therefore has a nonuniform scale, the amount of scale variation depending on the degree of tilt. A further source of difficulty is the distortion caused by physical imperfections of the photography, such as lens aberrations, camera movement during exposure, film curvature, and film shrinkage.

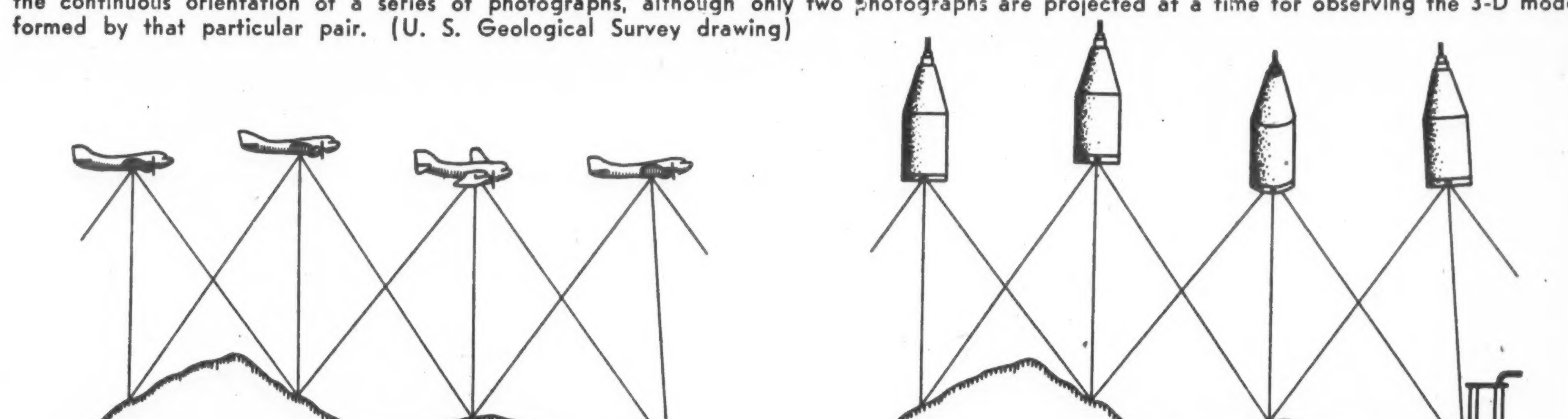
The problems of relief, tilt, and distortion relate to the conditions under which the photographs are taken. Another major problem of photogrammetry is the need for suitable control (points of known position and elevation) to enable the map compilation to be related properly to horizontal and vertical datums. Such control is usually obtained by ground-survey methods, a costly procedure. In some instances, the cost of ground-survey control has exceeded the cost of photogrammetric map compilation. In other instances involving inaccessible areas, ground-survey control has been obtained only at the cost of great risk to life and limb.

These four problems—relief, tilt, photographic imperfections, and control—are the fundamental problems of photogrammetry.

Solving the Problems

In modern photogrammetric practice, the problems of relief and tilt are generally solved by the use of stereoscopic plotting instruments. There are many varieties of such instruments ranging from low-cost apparatus of limited application to instruments of the highest order of accuracy costing some $50,000 each. The general principles are similar in all stereoscopic plotting instruments: A pair of overlapping photographs is oriented in the instrument to recover the relative orientation of the photographs which existed at the instant of exposure. A stereoscopic (3-D) viewing system is provided so that a miniature model of the terrain appears to be created. The model can be brought to the desired scale and oriented with respect to a datum, as

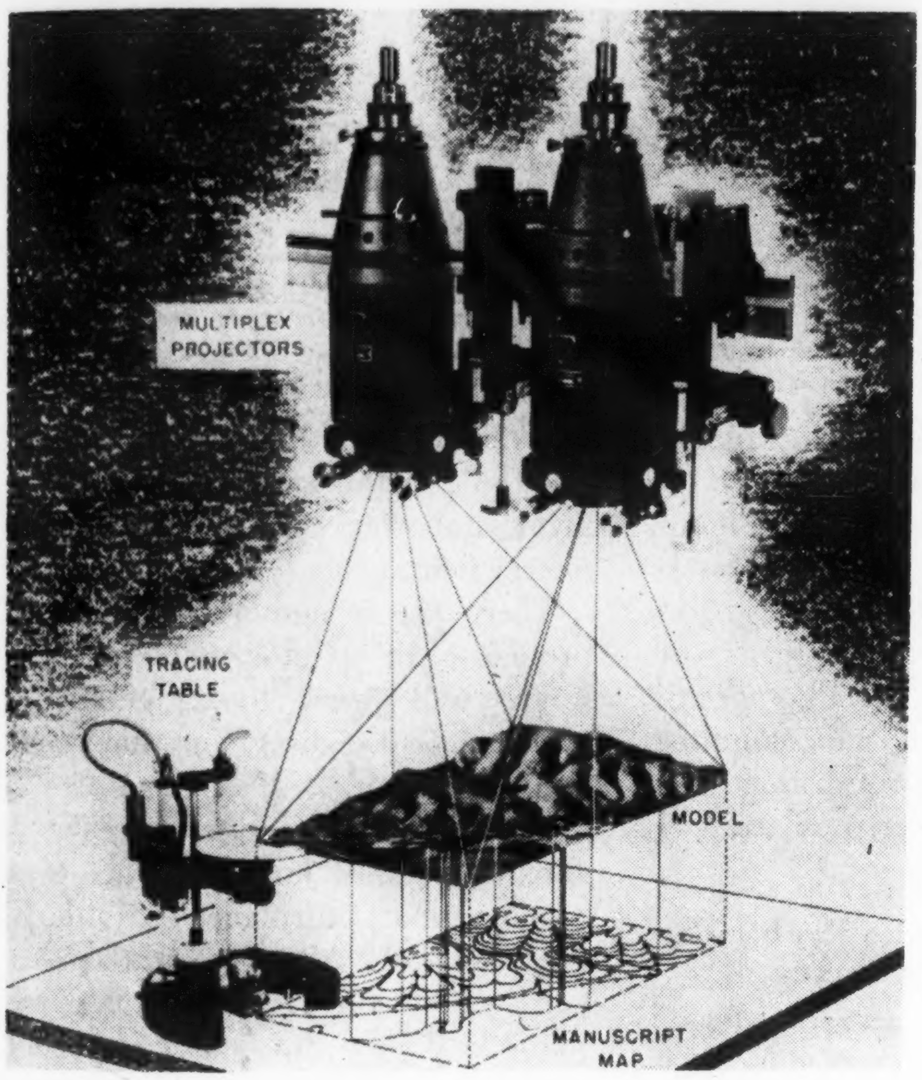
Aerial mapping. Modern stereoscopic plotting instruments reproduce the photographed terrain in miniature by recovering the position and orientation of the aerial camera at each exposure station. The multiplex, one of the most widely used map-plotting instruments, permits the continuous orientation of a series of photographs, although only two photographs are projected at a time for observing the 3-D model formed by that particular pair. (U. S. Geological Survey drawing)



represented by control points. Measurements are made, and map detail is transferred to a manuscript by means of a floating mark and a pencil which delineates the movements of the floating mark orthographically. As the three-dimensional model is similar in every respect to the terrain in nature, the tilt and relief displacements are automatically solved.

The problem of photographic deficiences is solved by providing means of compensating the known distortions of the aerial-camera lens and by perfecting as nearly as possible the mechanical operation of the camera and other photogrammetric equipment. While a complete solution to such problems has not been attained, the best equipment is now of such high order that the residual errors from this cause are negligible.

The solution of the control problem is still a widely-pursued object of photogrammetric research. In terrain of relatively easy access, old-time ground-survey methods are still the principal means of obtaining control for precise mapping. In difficult terrain, ground-survey methods can now be expedited by various means such as the use of helicopters for transportation, 2-way portable radios for communication, and precise phototheodolites for making field observations photographically. The problem of reducing the amount of ground-survey work required is being vigorously attacked by map makers with the collaboration, in some instances, of communications specialists. For it is in this area that photogrammetric techniques and communications techniques are on common ground. The efforts to apply electronic methods to the control problems have borne fruit in several directions, as we shall see.



Principle of the multiplex. The optical model formed by a pair of projected photographs is converted to a topographic map by means of the tracing table, a device for measuring and drawing details of the terrain. The photographs used in the multiplex projectors are printed on glass slides, called diapositives. A red filter is used in one projector, a blue-green one in the other; the observer wears corresponding spectacles to obtain the 3-D effect. (U.S. Geological Survey photo.)

How Communications Techniques Aid Photogrammetry

Although the applications of electronic techniques such as radar and shoran have not yet been refined sufficiently for use in obtaining directly the precise and relatively closely-spaced control required for high-order photogrammetric mapping, they have been used with some measure of success in obtaining control for photogrammetric mapping where a lesser order of accuracy is acceptable, and in establishing a triangulation network on which a denser pattern of precise photogrammetric control can be based.

Shoran has been used as a photogrammetric aid in two ways: triangulation surveys over lines too long for visual observations; and control of aerial photography flights. The same principle applies in both applications. An airborne transmitter sends radio pulse signals to two ground sets which receive the signals and return them to the airborne set. The time of travel of the signals to each of the ground stations and return is converted electronically by an airborne apparatus into a reading of the distance traveled by the radio wave. To obtain the geodetic distance between the airplane and each ground station, the electronic reading must be corrected for the effects of earth curvature, refraction, altitude, variations of the velocity of propagation, calibration and time delay in the equipment and other sources of error.

In shoran triangulation the sides of the triangle are measured instead of the angles. This is called trilateration. To measure the distance between any two triangulation stations, one of the ground sets is located at each of the two triangulation stations and the airborne set is flown across the line to be measured near its midpoint. When the airplane is directly over the line connecting the ground stations, the sum of the two measurements from the airborne set to each of the ground sets is a minimum. This minimum sum, properly corrected to obtain the geodetic length of the line, gives the distance between the triangulation stations.

In controlling flight lines by shoran, the electronically-measured distance from each of the ground sets, located at known positions, are recorded photographically at the instant of each exposure of the aerial camera. From these measurements, the position of the plumb point of each photograph can be computed to assist in the control of the photogrammetric compilation.

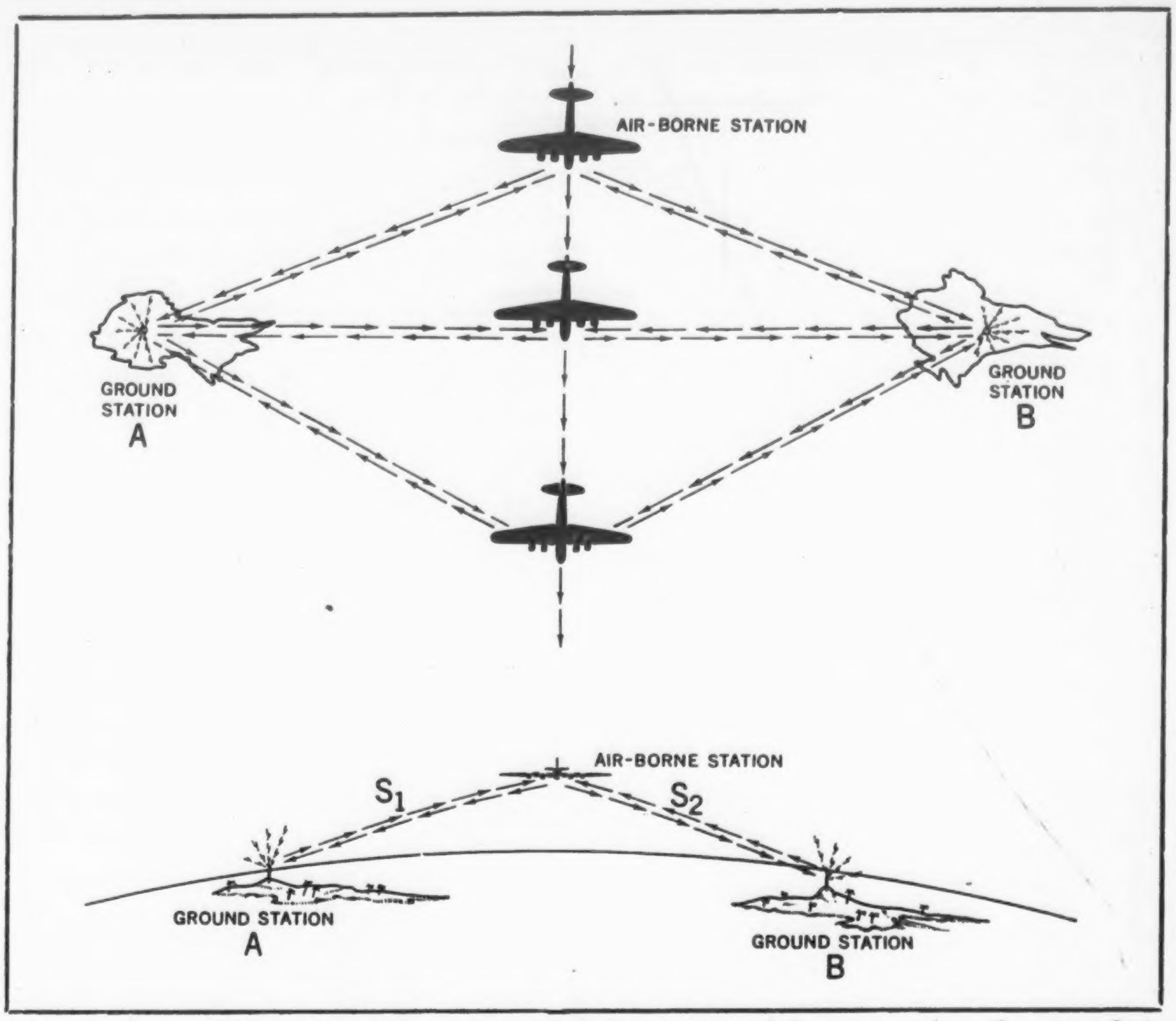
While shoran has proved to be an aid to photogrammetry in obtaining horizontal control, radar has, on the other hand, been used principally for obtaining vertical control. In "radar altimetry", the airplane with a radar-pulsing instrument and a graphic recording device synchronized with vertical photography first flies over a point of known elevation, such as a lake or seacoast. The elevation of the airplane at this point is determined by adding the radar-determined height of the plane above ground, to the known ground elevation. Deviations of the airplane from the nominal flying altitude are compensated by correction signals generated by a very sensitive barometric capsule,

sometimes called a datum stabilizer. The airplane is flown at constant pressure altitude over other points whose elevation are required. A radar-pulse "sounding" from the airplane to each of these ground points is subtracted from the known elevation of the airplane, to determine the ground elevation of the unknown points. The elevation of the airplane at the end of its run is checked by flying over another known elevation. This determines a "closure" for the flight which is distributed pro rata throughout the flight to determine the correct airplane elevation at each point. The method yields elevations sufficiently accurate for small-scale, large-interval topographic maps. If desired, a ground profile of the route of the airplane's flight is available on the graphic recorder.

A recent development for the precise measurement of base lines for triangulation is the Geodimeter, an instrument whose operation depends on the known value of the velocity of light. Light rays are emitted from the observing station to a reflecting target which may be as much as 20 miles away and returned by the reflector to the observing station, where the elapsed time is measured electronically and converted to distance. Measurements with the Geodimeter are reported to be of the highest order of accuracy.

Aerial photography combined with airborne magnetometer reconnaissance has proved to be of great value in mineral exploration. The magnetometer measures local variations in the intensity of the earth's magnetic field. By correlating the magnetometer record with the aerial photography, hidden bodies of ore can be located. The magnetometer method is not more reliable than surface methods using the dip-needle, but it is many times as fast.

A documentation of other applications of a parallel nature is available in the report of the Subcommittee on Application of Electronics in Photogrammetry, published in the March 1953 issue of "Photogrammetric Engineering," the quarterly journal of the American Society of Photogrammetry. In his report, Subcommittee Chairman Lyle G. Trorey lists no less than 35 published works relating to this subject.



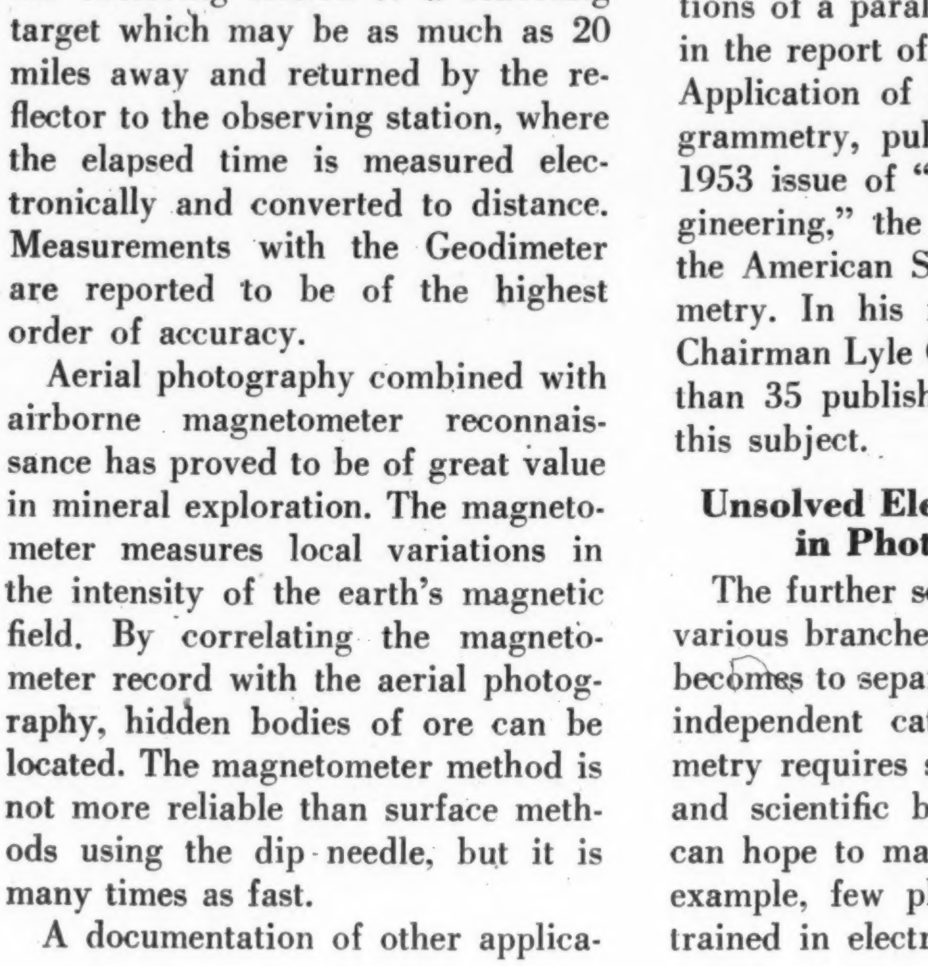
Shoran line crossing. The minimum sum of distances S_1 and S_2 occurs when the aircraft is on the line joining the ground stations A and B. The minimum distances are separately reduced to sea level, then added to obtain geodetic distance between the ground stations. (U. S. Coast and Geodetic Survey Drawing)

Unsolved Electronic Problems in Photogrammetry

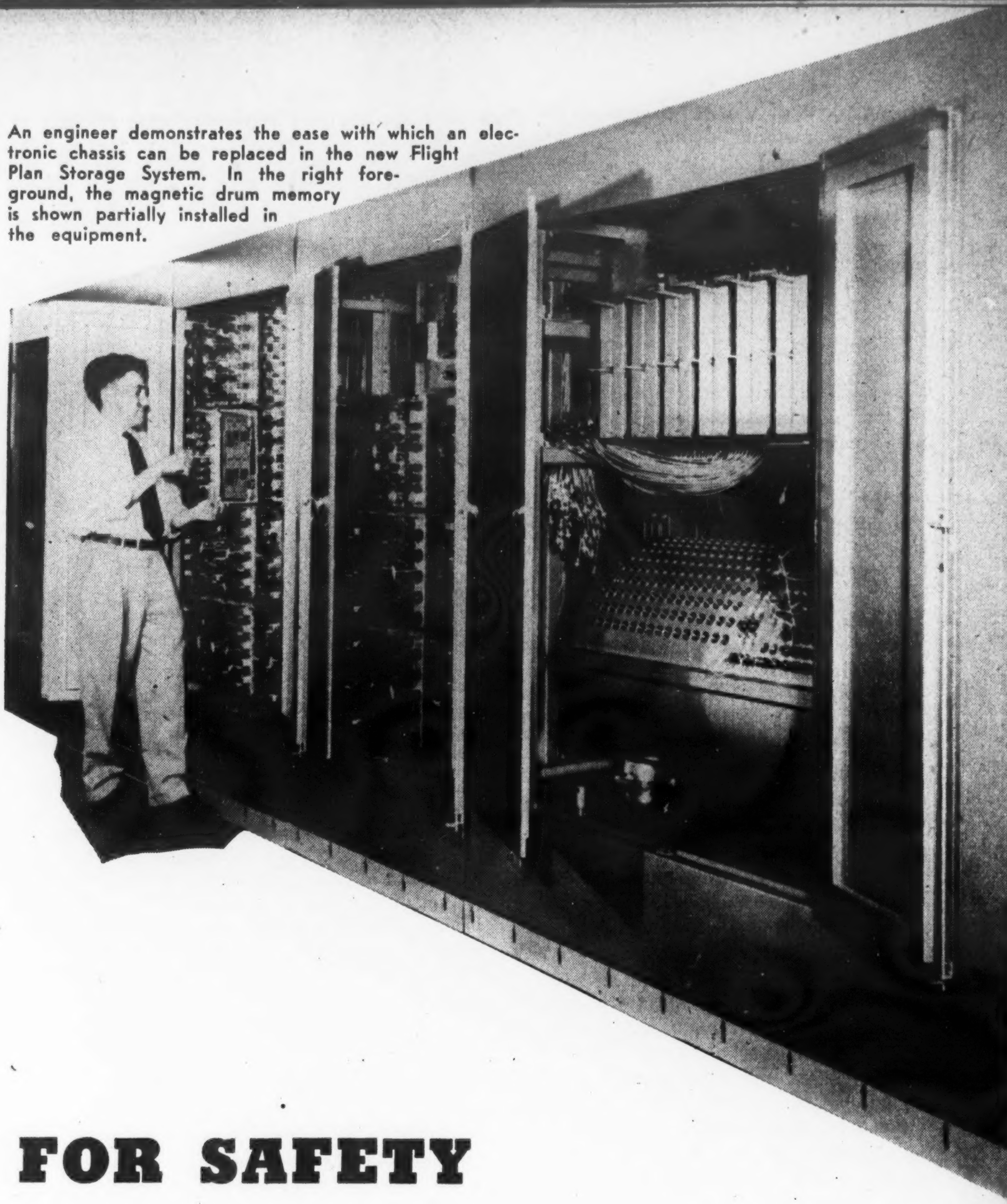
The further science advances in its various branches the more difficult it becomes to separate the branches into independent categories. Photogrammetry requires so many varied skills and scientific backgrounds that few can hope to master all of them. For example, few photogrammetrists are trained in electronics, and yet it appears inevitable that applications of electronic methods will one day be of prime importance in the photogrammetric field.

There are a number of unsolved problems in photogrammetry that might well merit the attention of electronics specialists. One that comes readily to mind is the need for a means of making *precise* shoran measurements from known points to a photographic airplane. Similarly, there is a need for *precise* radar measurements from a photographic airplane to the ground; more important still is the need for a means of accurately determining the altitude of the airplane above sea level at any position along its flight course.

To the energetic electronics man who would like to do something that would really revolutionize photogrammetry, the following project is suggested: Develop an electronic scanning system that integrates pairs of conjugate images on two overlapping photographs, so that positions and elevations of all points are automatically solved. To those of less ambitious mold, but who still desire to know more about photogrammetry, it is pointed out that the American Society of Photogrammetry has available a revised Manual of Photogrammetry.



Radar altimetry. The terrain clearance under the aircraft is recorded on a moving tape. Since the constant pressure altitude deviates from constant height above sea level, the profile record must be adjusted by reference to points of known elevation along the flight track. (Courtesy, Photographic Survey Corp., Ltd.)



An engineer demonstrates the ease with which an electronic chassis can be replaced in the new Flight Plan Storage System. In the right foreground, the magnetic drum memory is shown partially installed in the equipment.

STORAGE FOR SAFETY

The Engineering Research Associates division of Remington Rand Inc. recently developed an electronic system which speeds and simplifies flight plan filing and weather reporting.

A NEW ELECTRONIC WIZARD, which automatically controls airway traffic communications—one of the most complex problems in the nation's growing system of airlanes—is undergoing tests at the Civil Aeronautics Adminstration's technical development center at Indianapolis, Ind.

The new system, built around a remarkable "magnetic memory drum," is capable of shifting as many as 2,000 messages, plucking out information desired, and starting a reply back to the point of origin—all in less than a half-second.

The equipment was built by Remington Rand Inc. at its Engineering Research Associates division at St. Paul, Minn., originally for the purpose of handling pilots' flight plans, which are filed at the point of departure giving estimated times of departure and arrival, various times when the plane will pass over checkpoints and other essential information.

The purpose of the new device was to handle these reports automatically, checking them against other flight plans for conflicts, recording changes while the plane is en route, and reporting back to the point of origin and the destination.

However, the system is now being evaluated by CAA scientists and engineers for use in simplifying the vast system of airway communications, including not only flight plans but weather reports, traffic control messages, and other routine messages that keep thousands of miles of transcontinental teletype wires humming 24 hours a day.

The equipment is installed in a long room at one of the CAA buildings at the technical center in Indianapolis, with a control board and teletype machines clustered around it. The "electronic wizard" itself looks like a line of gray refrigerators, but within the plain cases is a complex

arrangement of wires, tubes, and the "magnetic memory drum," about 30 inches long and 22 inches in diameter.

The electronic system is connected with a newly designed "display board," built by the Union Switch and Signal division of Westinghouse Air Brake Corporation of Pittsburgh, Pa. The display board shows visibly certain basic information processed through the "memory drum," so the control operator can see the messages and replies.

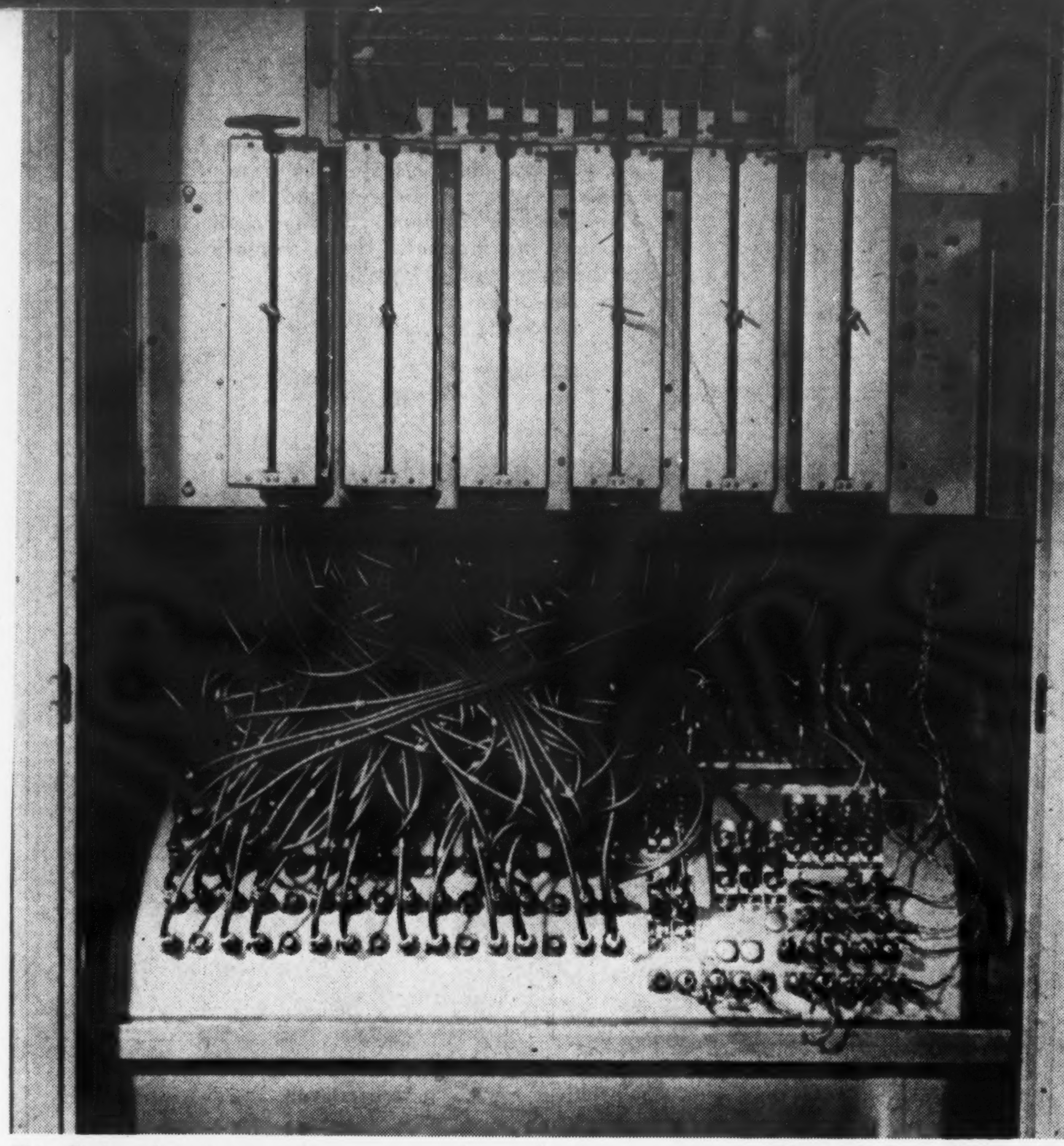
The new electronic equipment, designed to mechanize and speed up all communications required for airway traffic control, is part of an over-all nationwide air traffic control plan now under development by the CAA. Technically known as a "Message Storage and Processing System," it was designed and built by Remington Rand for the Air Navigation Development Board, which has turned it over to the CAA for testing.

The increasingly pressing problem of dispatching air traffic in recent years has been aggravated by the growing volume of air traffic to be monitored — military, private and commercial planes, operating at higher speeds and in increased numbers.

The problem of handling vast quantities of weather data, required for safe and efficient air traffic control, likewise has become aggravated, due to the increased numbers of messages needed for airway operations.

Briefly, the Message Storage and Processing Equipment, which will be located at regional Air Traffic Control Centers, will automatically:

1. Receive coded messages from several remote points by teletypewriter.
2. Examine these messages and perform certain clerical operations on them.



This flight plan storage drum can receive and store as many as 2,000 airplane flight plans simultaneously. The information is recorded on the magnetic surface of a revolving cylinder within the drum and automatically scanned with all other plans, corrected and revised as necessary before return to the sender. The entire operation takes less than 20 minutes.

3. File up to 2,000 such messages for split-second reference.
4. Locate any desired message and cause it to be typed out at one or more remote points.
5. Discard or enter in legal storage any message when notified that the message is no longer needed.

The equipment communicates by means of teletypewriter circuits and through a teletypewriter switching center with air route traffic control centers and a large number of airports and/or weather stations.

Any number of stations can be accommodated by the equipment as long as the total storage capacity required does not exceed 2,000 messages and the traffic rate does not exceed 1,300 words per minute. It has been estimated that twelve to fifteen Message Storage and Processing installations of the type described can service all of the major Air Traffic Control Centers in the nation.

To illustrate the use of the Message Storage and Processing Equipment, a hypothetical case of an air traffic control and weather problem is described as follows:

Pilot Johnson of the XYZ Corporation wishes to fly the company aircraft, N1234, from Rockford, Illinois, to Missoula, Montana. The pilot contacts the local weather bureau office at Rockford, Illinois, and requests weather forecasts for the route and for the destination airport at Missoula. In addition, he requests the current weather at several of the major airports en route.

The local weather bureau at Rockford has weather reports from stations in the immediate area, but to obtain forecasts and weather reports for stations outside of the local region, a request message is transmitted to the Message Storage and Processing System at Chicago for the balance of the information needed. This

In the old method, used by airport traffic control centers now, clearance is punched by telephone after it is figured out.

weather data is automatically returned by the Message Storage and Processing equipment. The total elapsed time from request to reply is about one minute. Of this total time, the electronic equipment takes less than a half-second to "comprehend" the message, locate the requested information on its "magnetic drum," and forward the information to the teletype switching center for transmission back to the requesting station.

Pilot Johnson then files a proposed flight plan with the local Air Traffic Control specifying:

a. The identification and type of aircraft.

b. The pilot's name, address, and certificate number.

c. The point of departure, altitude, and route of flight to destination.

d. The airspeed to be used.

e. The proposed time of departure, estimated time of arrival, and the hours of fuel.

f. The alternate airport.

Flight plan information is transmitted to the Flight Plan Storage System via teletype. As soon as this information is received, the equipment compares it to other flight plans already stored in the magnetic drum in order to automatically detect conflicts. If no conflict exists, the incoming message is stored in the drum "memory" for future reference.

The Rockford station forwards this flight plan message to the regional Control Center at Chicago. Upon receiving the flight plan message, the Message Storage and Processing Equipment automatically "reads the message" to make sure that it is "understandable." If it is in proper form, the system searches all flight plans already "on file" to make sure that a similar flight plan has not already been filed. If there is no such message on file, the system files the flight plan and returns a message to Rockford saying, "Message received and filed."

Clearance for the flight is issued, and this information is added to the flight plan in the electronic equipment to provide a complete record of the flight. Similarly, the departure time is added, and estimates over all check points are revised, based on the actual time of departure.

As the flight progresses, Pilot Johnson reports over the fixes en route and this information is also filed in the electronic equipment.

After arrival in Missoula, Mont., the tower transmits the arrival time and requests the electronic equipment to file the completed flight plan in legal storage.

While en route, the pilot was able to obtain complete weather information by transmitting his request to ground stations en route, who in turn forward the request to the regional center to obtain the latest weather reports.

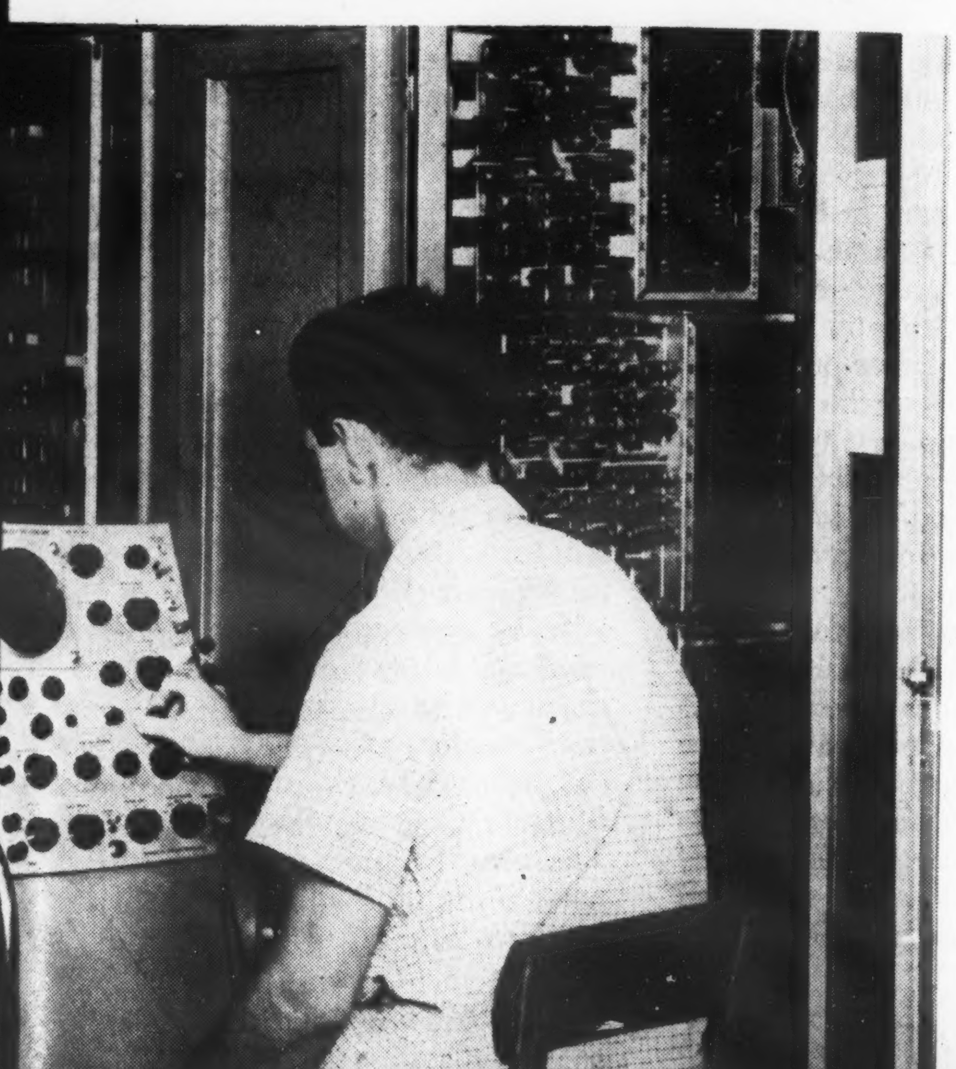
This hypothetical example involving a single flight illustrates the complex data handling required.

The weather capabilities of the Message Storage and Processing Equipment may be the first to be utilized in actual service. Under the present weather reporting system, individual station observation reports are collected from all over the country on a network time schedule, and "broadcast" by teletypewriter to the various weather stations.

Under this procedure, selecting a report for a particular station or group of stations requires a search through the entire network report to find the information desired. These "broadcasts" also include much which is irrelevant to many of the recipients. With present procedures, it is impractical to employ selection, editing, or grouping prior to each "broadcast." The users must monitor the entire "broadcast."

With the use of the electronic equipment, it will be practical to utilize this equipment as the central "reference file" for this information. Pilots can request specific weather data in a particular area, and the equipment will pluck out a particular message from among 2,000 in half a second.

It is current practice to have each weather observation station experiencing sudden changes in the weather situation send a "special" report. Using the Message Storage and Processing Equipment, these specials will replace the regular reports in the equipment and be available as the answer to each message asking, "What is the latest weather report for Podunk?"



An engineer uses an oscilloscope to check the operation of one of the electronic sections of the System. For ease of construction and maintenance, the equipment is built of electronic components which are mounted on standardized plug-in chassis, readily replaced.

International Radio Agreements and their Impact on Air Force Co

The background of present-day radio agreements, accur... give us better understanding and appreciation of world-...

THE DEPARTMENT OF THE AIR FORCE was established in August 1947 in a political climate that was conducive to international cooperation among nations. In this cooperative atmosphere, nations organized themselves to solve collectively the socio-political problems of the world. It was a period of great hope, shining ideas and good intentions. It was also a period when nations took inventory of the technical advances made during the war.

They found that the art of telecommunications had made great strides. As never before, quantities of communications equipment were available to link countries and continents. These equipments exploited new principles designed to increase the speed and reliability of communications.

New navigational aids guided aircraft along continental and transcontinental air routes. Landing devices which incorporated radar made all weather passenger schedules a possibility. Aircraft communications became an integral part of aircraft operation.

These radio services were essentially international in character. It was inevitable that governments would conclude agreements to foster and regulate these new services. Among these were agreements concerning the use of radio frequencies.

The international regulation of the use of radio frequencies has had a long history. It began in 1906 at the Berlin Conference of the International Radiotelegraph Union. This conference prescribed elementary rules to govern the infant radio service. The International Telecommunications Union succeeded the International Radiotelegraph Union in 1932. It was logical, therefore, that the ITU should continue as a forum for the nations of the world to discuss telecommunication problems. Seventy-eight nations took part in the first post war conference of the ITU at Atlantic City in May of 1947. Relations between delegations were cordial and after four months, the conference produced a blueprint for the future use and regulation of radio frequencies.

However, since 1947, the international political environment has altered. Military services have expanded as international relations have deteriorated; the use of radio frequencies has increased proportionately; there is a need for increasing flexibility of military communications which is difficult to accomplish within the framework of international agreements. As a result there have been serious doubts raised concerning the wisdom of pursuing the course laid down at Atlantic City.

In this article let us review briefly the post war conferences, assess their impact on the Air Force and draw some conclusion concerning the relative merits of these conferences in the light of existing conditions.

First, let us examine the results of the Administrative Radio Conference which convened in May 1947 at Atlantic City. This conference revised the Table of Frequency Allocations, which was originally conceived by the Washington Conference of the International Radiotelegraph Union. The original Table of Frequency Allocations was based on the philosophy that it was necessary to apportion the usable radio spectrum between the international radio services in order to protect these services from harmful interference and provide sufficient frequencies for future development. Successive conferences modified the table to include frequency allocations for new radio services. The Atlantic City Frequency Allocation Table modified the version produced at the Cairo Conference of the ITU in 1938 to provide spectrum space for the exclusive use of the aeronautical broadcasting service and the radio navigation services.

The Atlantic City Conference considered that it would be a major undertaking to implement the new table. Accordingly, the conference planned a series of international conferences to overhaul the existing frequency assignments. The end result was to be an international list of frequencies which conformed to the new allocation table. This list was to be engineered on the basis of requirements submitted by the member countries of the ITU.

To administer the list, the conference conceived the International Frequency Registration Board (IFRB). Its duties were to record radio frequency assignments, investigate cases of harmful interference and make recommendations to eliminate this interference.

It is interesting to note that the implementation of the Table of Frequency Allocations awaited completion of a new international frequency list. Similarly the IFRB could not function until the list was completed. The new list, therefore, was the cornerstone upon which depended the program envisaged at Atlantic City.

by
Major Seymour Stearns, USAF
Headquarters,
U. S. Air Forces in Europe

unications

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...munications operations.

The new list was to replace the Bern List of Frequencies which was first published by the ITU in 1928. From the practical point of view the Bern List was of little use. It did not represent actual operations. In fact, the Russians had notified the ITU of operations on every ten kilocycles in some portions of the spectrum and every five in others. However, it was the practice for nations to use the Bern List as a means of establishing prior rights to frequencies based upon the date of notification. For this reason the List proved hard to kill.

From 1947 to 1951 twelve conferences convened to complete the work outlined at Atlantic City. Each of these conferences dealt with segments of the radio spectrum allocated for use of a specific radio service. These conferences were to produce frequency lists for the aeronautical, maritime mobile, land mobile, fixed broadcasting and radio navigational services. In accordance with the Atlantic City blueprint, a single authoritative world conference would approve and combine these lists. The new international frequency list would come into existence, the Table of Frequency Allocations would come into force, and the IFRB would begin to function on behalf of the member nations of the ITU.

Unfortunately, the comradeship of the early post war years did not bear the test of time. The USSR faced the propect of discarding the old Bern List reluctantly. They steadfastly refused to furnish information on radio stations within the USSR and they began to use the conferences as a sounding board for political propaganda. The satellites followed suit with monotonous regularity. Many of the conferences could not be brought to a successful conclusion. The USSR and her satellites did not sign many of the agreements.

This was the backdrop of the Extraordinary Administrative Radio Conference (EARC) which was held in Geneva, Switzerland in 1951. At Atlantic City, the technical planners envisaged that a conference such as this would produce a new international frequency list on the basis of agreements reached between the two conferences. However, the EARC had almost no agreed lists to work with. In addition, international relations had become badly strained. Indeed, the conference had been postponed in 1950 because of the political situation. In order to carry out the course set at Atlantic City in 1947, the conference faced the task of salvaging the bits and pieces of the intervening conference. It is conceivable that the prestige and effectiveness of the ITU hung dangerously in the balance.

After three months, sixty eight countries signed the final agreement. The USSR and her satellites were not signatories. The new international frequency list was adopted for low and medium frequencies only and the corresponding portions of the Frequency Allocation Table came into force.

The conference was unable to produce a list for the high frequency portion of the radio spectrum. It did, however, produce a method of implementing, de facto, the high frequency portion of the Table of Frequency Allocations. This approach provided that countries would adjust their operations on a voluntary basis to conform with the allocation table.

To administer the new lists and to assist countries in the adjustment of their radio frequencies, the conference established, at long last, the International Frequency Registration Board. Finally the conference provided for the replacement of the Bern List with a new document, the Radio Frequency Record. This document has had its second printing and presents detailed information submitted by countries on the current use of their radio frequencies. In accordance with the agreement, the Radio Frequency Record will serve as an interim international frequency list until some future conference of the ITU adopts the new International Frequency List for all portions of the spectrum.

Let us review the effect of these agreements on the Air Force. We should note at the outset that the United States is pursuing the implementation of the Extraordinary Administrative Radio Conference agreements as a matter of national policy. The Air Force in conjunction with other government and non-government agencies is adjusting its operations to conform with the Table of Frequency Allocations. Admittedly, we are exchanging in many cases reliable frequencies for frequencies which may suffer some degree of interference during the period of adjustment. This is particularly true in the case of the fixed or "point-to-point" radio circuits. The new aeronautical frequency bands have been carved largely from spectrum space which was allocated to the fixed service in the Cairo Table of Frequency Allocations. Fixed operations must be compressed into a smaller space than available under the Cairo allocations. We must, therefore, accept a lesser degree of protection for frequencies operating in the spectrum space allocated to the fixed service under the Atlantic City Frequency Allocation Table. On the other hand, we have obtained useful spectrum space in the form of clear channels in the aeronautical frequency bands.

These are the major areas of impact on the Air Force in terms of spectrum space. In terms of flexibility, the Extraordinary Administrative Radio Conference agreements have not proved to be a strait jacket to Air Force communications. This has been largely the result of the voluntary nature of much of the Extraordinary Administrative Radio Conference agreements.

In a larger sense the Extraordinary Administrative Radio Conference agreements are a remarkable demonstration of cooperation among the free nations of the world. This cooperation overshadows the purely technical aspects of the agreements. It is an example of the determination of these countries to maintain order in the radio spectrum. Finally, it gives us the assurance that military and civilian radio communications can continue to coexist in this period of protracted political tension.

Captain Robert W. Danford, SigC

DIG IN!

Camp Gordon's 990th Signal Support Company (Large Base) went underground in Exercise FLASH BURN to demonstrate the "new look" in signal communications under conditions of atomic warfare.

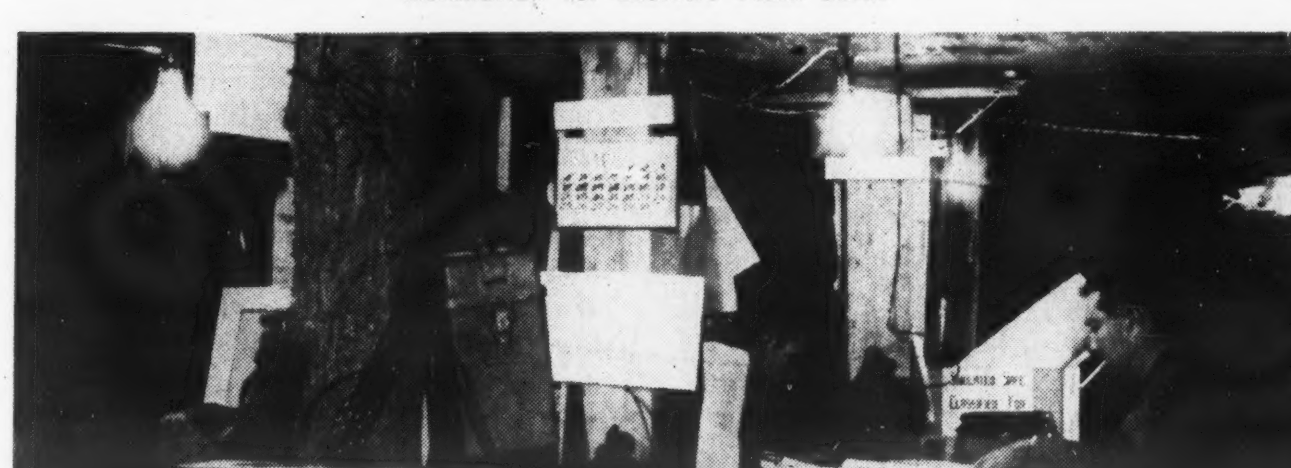
In treating the "war of the future" theme, some writers depict scenes in which tense figures live and work below the surface of the earth in hidden installations while above them the boiling fury of atomic weapons is unleashed in the now familiar concept of total war.

During Exercise Flash Burn, held in the Fort Bragg-Camp Mackall, North Carolina area in April and May, observers witnessed translation of this science-fiction concept into terms of actual field operations in the "fighting zone" of what proved to be an exciting and realistic "atomic war."

Physically, Flash Burn looked pretty much like any large-scale maneuver held in the south, with rolling convoys on the dusty roads, field positions and huge C-119's and 124's circling for ponderous landings at the airhead to disgorge troops and supplies in a steady stream.

But, in the distance, smoke mush-

A view of the interior of the orderly room bunker at the 990th Signal Support Company's installation for Exercise Flash Burn.



roomed high into the air, simulating an atomic burst on the battlefield. *That* was the real character of FLASH BURN.

The heavily massed forces in solid depth that marked past maneuvers were missing, proving that atomic weapons have written off many of the old rules. In their stead, units obeyed the new combat laws of dispersal and its corollary, mobility.

When the simulated conditions imposed by maneuver planners indicated an unusual deployment of forces for all units participating in the exercise, Captain John W. Lueddeke, Commanding Officer of the 990th Signal Support Company (Large Base), seized on the opportunity to test the idea of passive defense against atomic attack in terms of the signal communications organization. Accordingly, he ordered his operating and administrative sections dug in, and the 990th went underground literally.

How the unit dug itself in is an interesting study in how to make ingenuity and planning in the field pay off.

First, however, a word about FLASH BURN—the largest maneuver of its kind in this country since World War II.

It was planned to test Army units in offensive and defensive operations, including tactical air and airborne activities, with conditions of atomic warfare written into the picture.

The general situation presumed for the exercise was a state of war between the United States and the Aggressor, the latter being lodged on the southeastern coast of the United States in an area that extended coastwise from Georgetown, South Carolina to New Bern, North Carolina, and inland from Kinston, North Carolina to Cheraw, South Carolina. The situation handed the US forces was a tough one. In holding up its end of FLASH BURN, the 990th demonstrated conclusively that it is possible for personnel of a Signal support unit to completely dig in its means of communication without assistance, in order to achieve at least minimum protection, and to continue to operate in the bargain.

Had the maneuver been the real thing, it is highly likely that the only appreciable danger to the 990th's installations might have resulted from radioactivity.

Underground construction amounted to total of 1500 cubic feet of compartment space with approximately 80 per cent of the digging done with hand tools. Thus the matter of actually moving the great quantity of earth displaced revolved around a stout shovel in the hands of a willing individual.

These Signal Corps men are shown operating teletype equipment, installed underground for atomic warfare defense, during the maneuvers in North Carolina.

The dug-in sections were divided into three major areas: company headquarters, motor repair, and a combination switchboard and message center area.

Compartments were connected by a maze of tunnels, which straightened out would have totalled 1500 feet; they were of comfortable height and staggered in such a way that minimum blast and flash effects would have resulted had atomic explosions been real.

The underground motor pool was designed to allow for ramp entrance from the surface of the earth by vehicles ranging in size from a jeep to a 2½-ton cargo truck.

The buried message center and telephone exchange were referred to as the "Country Club" by some people (who probably didn't get to work there) because of the almost comfortable working conditions.

The 990th took to the field with 13 officers, seven warrant officers and 207 enlisted men.

The entrance to the orderly room bunker typifies the sturdiness of the dug-in quarters of the 990th.

In general, the mission of the unit consisted of operations and services including switchboard, teletypewriter, fixed radio, storage and issue of supplies, inspection and maintenance, photography, message center and messengers, and cryptography.

Freedom of movement on the part of major commanders in any carefully planned exercise is always somewhat restricted because the pre-planning removes much of the necessity for staff action and decision. This is done to place movements on an objective basis. Action is narrowed and tightly controlled to achieve the maximum benefit from a minimum expenditure of time, funds, and personnel.

This was true in FLASH BURN and one effect it exercised on communications was to prevent a true test of communications capability and capacity. Since prior planning, as noted, had removed the need for extensive coordination and exchange of information among commanders and staffs, the message load was not realistic.

Events found the telephone system greatly overloaded with calls and, generally speaking, if there was anything typical about communications in the maneuver, it must be supposed that it was this.

However, FLASH BURN was a big success and outfits like the 990th, which were manned to a certain extent with personnel of comparatively little experience in field operations, benefited in many ways.

And what did the 990th plan to do with the great holes they had dug for the occasion? Fill them in, of course!

8th Annual AFÇA Convention Report, continued from the July-August 1954 issue

SYMPOSIUM ON CONTINENTAL DEFENSE

May 6, 1954—Shoreham Hotel, Washington, D. C.

These talks by our government and military leaders on the problems of continental defense are reprinted for the general information of our readers and as an impetus to them for the implementation of local and national defense projects.

The Air Defense Command

General Smith

IT IS A DISTINCT PLEASURE TO PARTICIPATE IN THIS symposium before a gathering such as this—including, as it does, many persons, both military and civilian, who have had a part in the significant technical advances of the last few years. I know that an examination of the vast job of air defense—with particular reference to the role of communications and electronics—will meet with an immediate appreciation of the complex technical problems involved.

I say "complex" because many of the problems of air defense are just that. They involve technical considerations on a scale which, proportionate to the growing complexity of this atomic and thermonuclear day, challenge the best of our brains and the fullest measure of our ability to work together as an Armed Forces-Industry team in finding their solutions.

That the brains are here I know. That you have a sincere interest in working together is indicated by your very presence here—and the creed of your organization. This creed—somewhat liberally interpreted—is to *provide a partnership of members of the military and civilians in industry dedicated to promoting the security of the United States through industrial preparedness.*

Your goal is to improve the cooperation between the Armed Forces and Industry in the design, production, maintenance, and operation of equipment vital to our country's security. This means—in the particular application considered here this afternoon—the communications and electronic devices which might be described as the "eyes, ears, and nerves" of air defense.

Gentlemen, this goal is so closely related to the over-all problem of air defense that there is no question about our being in this together.

National security, in a broad sense, is everyone's business. But in this particular application, since communications and electronics are so closely integrated in air defense, there is special need for working together.

Since the advent of the modern bomber, adequate air defense has always required relatively complex technical systems; when we add to the bomber modern weapons of mass destruction, we multiply by several orders of magnitude the complexity of the equipments necessary to counter the threat.

"Defend the United States against air attack." This is the Air Defense Command's Mission. Just seven words—with no ifs, ands or buts—and no hints as to the time, place, or nature of such an air attack. It is a simple enough statement in itself, but the magnitude of the undertaking becomes alarmingly apparent when one considers that the United States means 3,000,000 square miles of land with 10,000 miles of boundary—and that the responsibility extends upward some eight—ten—or more miles into the third dimension of the sky.

By the same token, and from the particular viewpoint of our discussions here, the complexity of the problem is more fully apparent when one considers that all of this area—in the air and on the ground—must be bound together by communications and electronics systems which make it possible to alert and defend either a part or the whole as the case might be.

The grave responsibility which we carry causes worry and sleepless nights at our headquarters. Since 1948, starting essentially from scratch, we have worked toward the creation of an air defense system for the protection of the United States. This system as it is now, and as it should be with the technical improvements which we envisage, is what I will later describe.

First, however, let us take a look at the threat. Then we'll take a look at the problems posed by the threat.

You are all aware of the general nature of the atomic threat facing us. I will not attempt to amplify this, but I will add some details on the Russian capability to carry out such a threat.

We *know,* for instance, that the Soviet Union has copied and improved upon our 4-engine bomber, the B-29, and has built over a thousand of these improved planes.

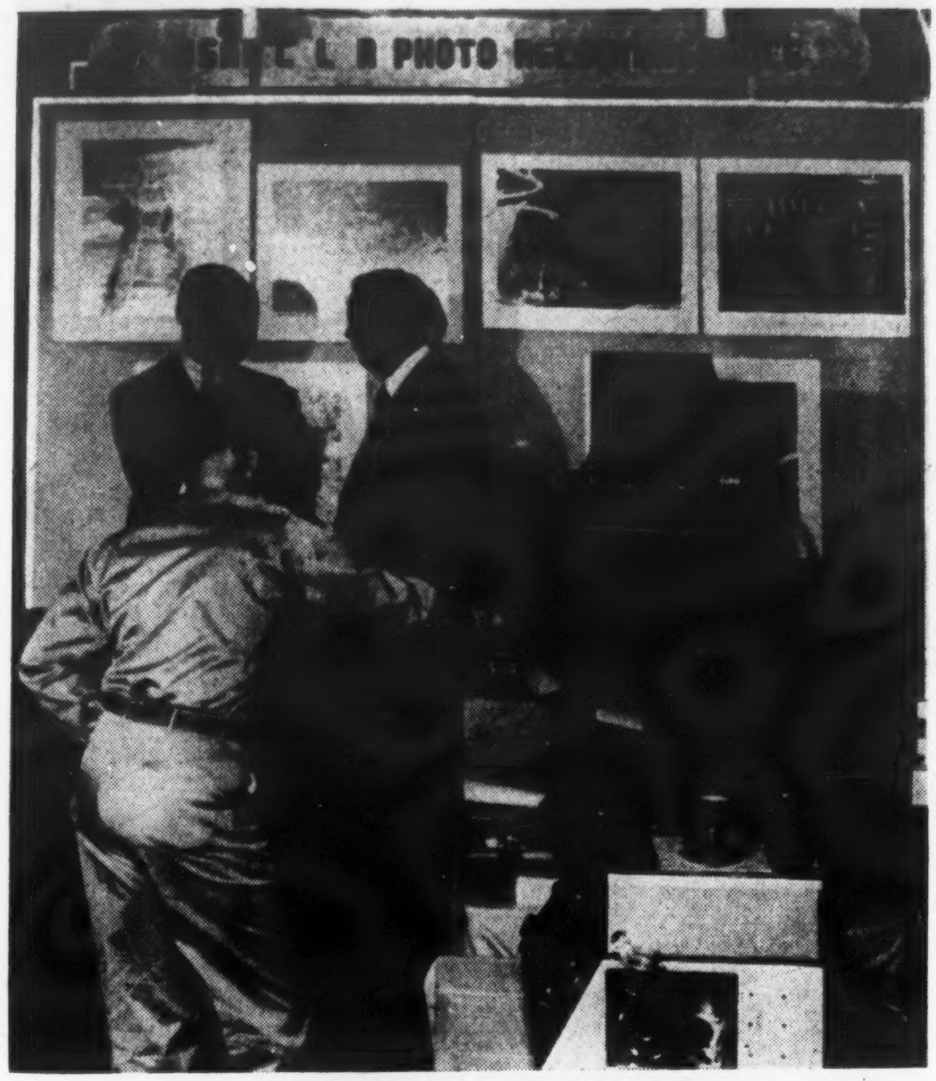
We *know* that this airplane—stripped of equipment except for necessary navigation and bombing gadgetry—

Major General Frederic H. Smith, Jr., USAF
Deputy Commander
Air Defense Command

The Honorable Arthur S. Flemming
Director
Office of Defense Mobilization

The Honorable Val Peterson
Administrator
Federal Civil Defense Administration

Frederick R. Lack
representing Industry
Vice President
Western Electric Company



This exhibit of Air Force color photo reconnaissance featured color prints made at various overseas theaters of operation.

has the range to reach and attack all the principal targets of this country on one-way or air-refueled missions.

We *know* that they have still better and faster airplanes under development and test. Recent disclosures as to their new aircraft developments indicate that they are moving ahead rapidly in this field.

And we *know* that several months past, the Soviet Union created an explosion of a thermonuclear device, a development which can lead on to the H-Bomb—lead on to a bomb that is measured *not* just in tens of thousands, or hundreds of thousands of tons equivalent of TNT—but in megatons, in millions of tons equivalent of TNT.

More exact intelligence of the Russian capability cannot be given—for obvious reasons. But this much can be said. We know that today the Soviet Union has the capability to attack us through the air with weapons of mass destruction—weapons which, if delivered without interference, could in a single series of coordinated blows destroy our industry, immobilize our military forces, and emasculate our will to resist. It can also be said that this capability covers high or low altitude methods of attack, in daylight or in darkness, and many avenues of approach.

What this capability will be at any specific time in the future is a matter of conjecture. It is obvious, of course, that it is improving rapidly with time, and it is safe to say that in, say 1958, the Russians might well have the capability of putting several thousand aircraft into the air against us.

Even on a suppositional basis, this leads to one immediate conclusion. Since such an attack in force could come at any one, or several places, it means that we must have a great increase in control capability in air defense to meet the obvious dangers of this build-up.

That is where you come in—where the role of communications and electronics becomes vital to the future effectiveness of our air defense system. Because control capability *means* communications and electronics. It means data links and other devices for the rapid and accurate transfer and assimilation of large quantities of tactical information. It means a vast sensitive system of communications and electronics to give hair-trigger precision and perception to our entire network.

Basic Principles of Air Defense

Generally, this pattern of military and civil air raid warning reflects the basic principles of air defense. These principles generate certain requirements and failure to meet any of these requirements seriously reduces the effectiveness of any system that we might devise.

What are these principles? They're fairly easy to state! Pretty difficult to accomplish! And basically, there are only four of them.

The *first principle*, not necessarily in order of importance, is that the air defense system must provide sufficient *warning* and *protection* for our own offensive striking force—our long-range strategic air effort—to insure that the initial enemy mass attack or series of attacks will not reduce to an ineffective level our own capability to develop counterblows, to strike back still harder and with devastating force.

For it's a *dead certainty*, and let me drive this fact home, that no defense system, no matter what degree of effectiveness we ultimately attain, can alone bring victory. The old military truism, "that the best *de*fense is a good *of*fense," still stands! Consequently, it's vital to the security of our nation that we be in a position to take immediate offensive action not only to reduce the enemy's attack capability at its source but to proceed methodically, and quickly, to destroy his war-making capability.

The military force of our country most capable of launching an immediate retaliatory counterattack against all critical enemy target areas is our own Strategic Air Command—our aerial long-range striking force with its terrific Sunday punch. Any defense system which fails to provide the *warning time* and *the air protection* necessary to preserve that vital retaliatory capability is not fulfilling its mission.

The *second principle* is one which is particularly perti-

nent to this audience consisting, as it does, of many executives and engineers representing industrial firms in the communications, electronics and photographic fields. The air defense system must provide sufficient protection for the nation's economy, its industries, to assure *sustained support for the war effort.*

As representatives of industry, and as technical representatives of the Armed Forces, you are all familiar with our mobilization materiel requirements. You are thus aware of the rapid and everchanging nature of today's weapon of war. Because of this rapid and progressive development, the obsolescence rate of weapons is almost equally rapid.

It is thus impractical and beyond good common sense to attempt to create, in this day and age, huge stockpiles of "today's" weapons beyond that "mobilization reserve" necessary to permit our essential war industry to swing into high gear for the necessary military program should war come. In considering these factors, a careful economic balance is mandatory, and protection of our hard-core war industry to insure tomorrow's weapons is equally mandatory—protection to the maximum level we can achieve within the defense system in being.

Third Principle Most Important

The Defense System must provide sufficient protection for the people of this nation to assure their physical and their psychological ability to carry on with the operation of our industries and our military machine.

This is perhaps the guiding principle and most important of all. It would seem of little purpose for us to protect our military forces and our industrial potential if we while so protecting accepted such destruction of our population that the people of this nation were unable or unwilling to fight back.

Should fear or panic ever destroy our national will—the iron will and determination of our people to carry the war to the enemy at all costs regardless of our *then* military posture or our industrial potential—we could possibly lose to the enemy by default.

Now, lastly, the defense system as finally determined must be established within the economic capability of this nation to build, and to maintain, and *sustain* a combined offensive-defensive "survival force."

This last principle is perhaps the most difficult of all to interpret and to assess fully. There would be little purpose in building a purely defensive system so elaborate that the cost would bankrupt the country leaving little of economic value to defend, or leaving this nation without an offensive force to carry the war straight back to the heartland of the enemy.

Measured against the magnitude of the air defense problem that this country faces, it's well within the realm of possibility to design *unwittingly* and at the expense of the offensive effort, such a purely "defensive" system.

Let's look briefly at the basic requirements of air defense. To defend our nation against the existing threat requires a system that will, first of all, provide adequate warning. We must have a system that will provide a detection capability extending far enough outward from our borders and our coastal areas to allow the necessary *time* for *interception and air battle* by our fighter planes, and for action by our fighter planes, and for action by our local antiaircraft defenses. We must have the *maximum* "early warning" attainable, both in order to bring our military defense system up to its fullest effectiveness and to alert our civil defense system to the approaching danger.

Next, our air defense system requires high-proficiency fighter-interceptor aircraft capable of making interception in any kind of weather—rain or shine—day or night—winter or summer.

It requires antiaircraft guns and "ground-to-air" guided missiles for the close-in protection of specific targets against those hostile bombers or missiles which may have succeeded in penetrating our outer fighter defenses.

It requires, and this again has particular application here this afternoon, the most complex, but reliable and foolproof control communications systems ever devised by man.

It requires real estate, often very valuable real estate, on which to locate the fighter squadrons, the radar bases and control centers and the antiaircraft and guided missile battalions.

Above all, it requires highly skilled people, thousands upon thousands working round the clock, seven days a week, to operate and maintain this complex equipment and still more people to provide the essential logistic support for the air and the ground crews.

These, gentlemen, are the requirements. Now, let's see what our air defense capability is today.

Obviously, I cannot tell you exactly how much air raid warning time we gain today through the existing air defense system. That would be too much of a convenience to a possible enemy. But I can say this. It is not enough! It is not enough to conform adequately to the basic purposes of an air raid warning system to permit fulfillment of the first three basic principles of air defense that we have examined. We *have* warning, but it is *not* enough to meet the threat inherent in the ever-increasing speeds, altitudes, navigational accuracy, and radar bombing capabilities of the modern bomber.

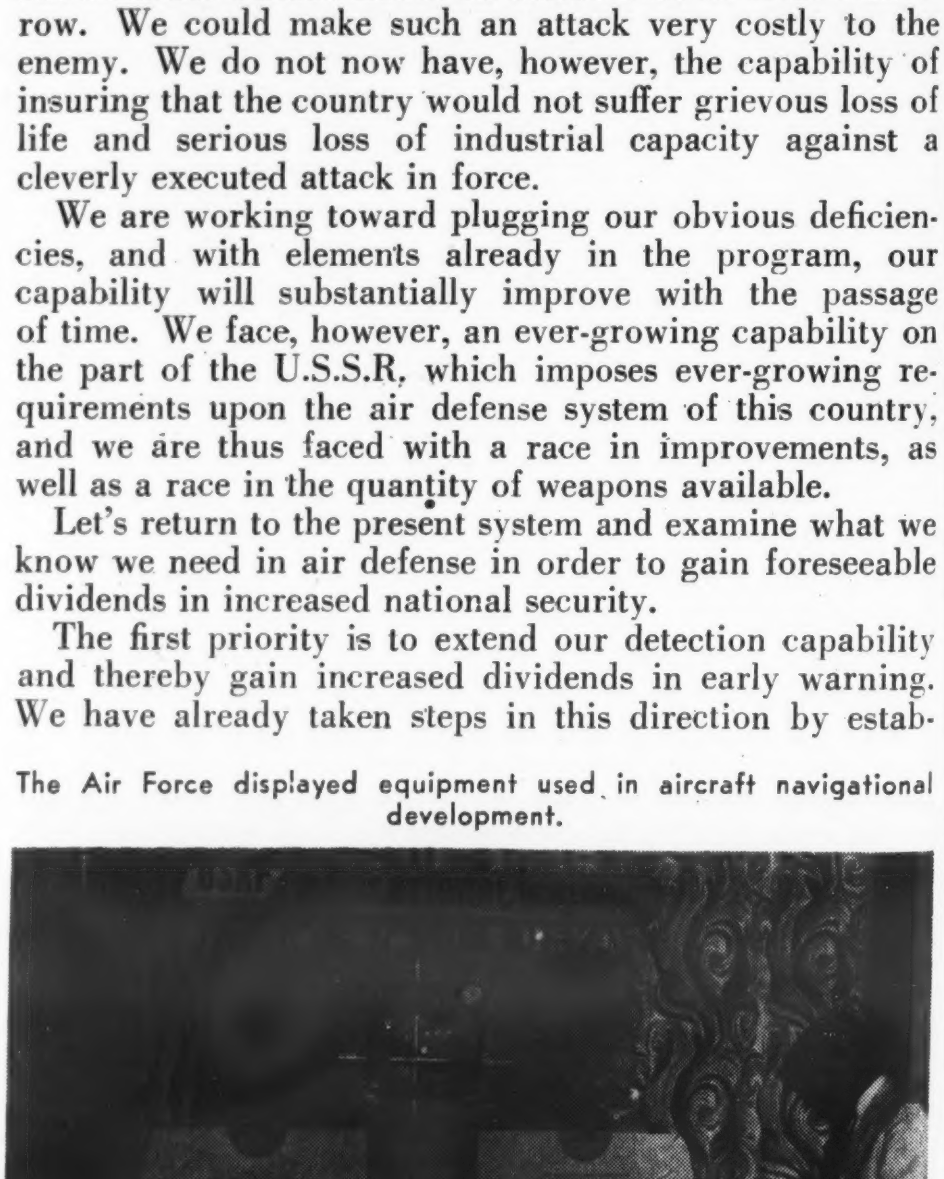
I cannot give you our considered assessment in terms of numbers or percentage of bombers we would expect to kill before bomb release line if an attack were to come tomorrow. We could make such an attack very costly to the enemy. We do not now have, however, the capability of insuring that the country would not suffer grievous loss of life and serious loss of industrial capacity against a cleverly executed attack in force.

We are working toward plugging our obvious deficiencies, and with elements already in the program, our capability will substantially improve with the passage of time. We face, however, an ever-growing capability on the part of the U.S.S.R. which imposes ever-growing requirements upon the air defense system of this country, and we are thus faced with a race in improvements, as well as a race in the quantity of weapons available.

Let's return to the present system and examine what we know we need in air defense in order to gain foreseeable dividends in increased national security.

The first priority is to extend our detection capability and thereby gain increased dividends in early warning. We have already taken steps in this direction by estab-

The Air Force displayed equipment used in aircraft navigational development.



lishing our Northern advance guard, so to speak. We also are well into the development of an airborne early warning and control program which will extend our detection capability well to seaward off both coasts. Obviously, however, this advanced early warning must be pushed further, and so steps already have been taken at the highest planning level to investigate the advisability and the ways and means of putting an early warning net across the continental rim.

As already publicly revealed, certain experimental equipments for such a net are in place. Studies have been made of the phasing into such a net of inexpensive "radar fence" type alerting equipments.

These known means of improving our continental defenses are well into the development stages. What its fulfillment would mean in terms of increased security is immediately apparent. It would mean advanced early warning of several hours in most instances. This, in turn, would mean increased—and in the future, critical—margins for the fulfillment of the three primary purposes of an air raid warning system: Namely:

(1) To provide time for the civilian population to take appropriate passive measures.
(2) To initiate active air defense.
(3) To insure retaliatory attack by our own long-range strategic arm.

To indicate the exact gain in early warning time would be to make unwarranted revelations about our present capability. But I can assure you that this gain, in the event of actual attack, would be felt in untold numbers of lives saved, in an increased flexibility of active air defense to meet and counter an attack, and in the exercise of our own retaliatory power.

Improvements for Electronics Field

Now to communications and electronics in air defense. This also happens to be one of the known provinces for necessary and foreseeable improvements. It is also one of the most important, since ability to meet and counter enemy capability for large-scale and diversified attacks in the future will depend upon the integrated employment of the most advanced communications and electronics devices. Advances in speed and range of bombers and in the general capability for surprise and swift destruction through the air require that we have corresponding advances in the instrumentalities to meet all conceivable threats. Some of the areas of improvement can be reviewed briefly.

I have mentioned computers. Everyone here is aware of the almost phenomenal advances in this field, in design and capability, as well as application. Computers will soon become a reality in air defense not to replace the element of human judgment, but to take over many repetitive and tiresome functions which cause humans to "miss." These computers permit us to inject into our air defense system that degree of automaticity, and that increased capacity essential to meet the increased speed and number of an enemy's weapons of tomorrow.

Another development is closely related. This is in the field of data transmission which will provide the final, time-saving factor in the high-speed, split-second air war of tomorrow. Your contributions in this area soon may reduce to a fraction the time previously required for the transmission of air defense information within the system. Because of the promising developments in this field, there is little doubt that in the not-too-distant future our planes and missiles will be ground controlled—in the most advanced sense of this term.

As you know, our radars are being improved to provide the type of coverage we need. While this admittedly is a long pull, we have been successful in improving the development-production timetable. We do have now improved radar equipment in our system, and with your aid will continually investigate new technology, ideas and procedures to improve our data gathering facilities.

At the Naval Ordnance Laboratory, a visit to the Magnetics Division's laboratories was a part of the program. Here, Mr. P. W. Barnhart is explaining the magnetic amplifiers developed at the Laboratory and their use in special servo systems.

These are some of the known areas of improvement in which tangible results are already "in the mill," so to speak. There are others, some representing equally important communications and electronic refinements in our fighter and missile capabilities.

There are as yet unknown areas upon which we must await the results of basic and applied research. We are facing a highly competent potential enemy, and our salvation must lie in beating him to the technological punch. We look to you for these improvements as the need can be foreseen.

Your opportunity to take an active part in the continuing preparation of this country's defenses is obvious. As I have indicated, the air defense pattern for tomorrow must involve increasingly the communications and electronics field; your field for the type of continuing cooperation which is the purpose of this organization.

In closing, I want to quote two lines from the foreword to a prospectus of your organization. They say—

". . . . In the first half of this century we have been in two big wars. They were different than previous wars because, in far greater measure than ever before, supremacy in science and industry was necessary for victory. . . ."

This, gentlemen, is your charter for your continuing cooperation in the common job of air defense. But I want to leave you with one thought. We have mentioned the need for some final balance in the economic aspects of air defense. Such a determination requires intensive and continuous studies at all levels—at the very highest levels—and in industry. It is being reviewed and analyzed by all of our military and civilian leaders; by the National Security Council; by the Joint Chiefs of Staff; by the Air Defense Command and Army Antiaircraft Command; by our Intelligence agencies; and by many scientists and military men well versed in ramifications of this problem of air defense.

Part of the decision is up to everyone. Because, again, we're all in this together. Air defense isn't just the Air Defense Command's problem—it's not just the problem of the military. It is the problem of 160 million Americans—it is *your* problem. What you may be able to conceive in the field of communications and electronics may be one of the important factors, one of the essential contributions toward providing more defense within the limits of our ability to sustain its economic burden.

Symposium on Continental Defense, continued

The Office of Defense Mobilization

Dr. Flemming

Dr. Flemming, addressing Convention members at the Symposium. In the background is Maj. Gen. Frederic H. Smith, Jr., USAF.

I HAVE BEEN ASKED TO FIT THE SUBJECT YOU HAVE under discussion this afternoon into the over-all setting as far as defense mobilization is concerned.

I think that most of you are aware of the fact that, under the law setting up the Office of Defense Mobilization, it has the responsibility of coordinating on behalf of the President all aspects of the defense mobilization program, including production, procurement, transportation, communication, manpower, etc. Certainly the members of this group are fully appreciative of the setting in which we carry forward our defense program. I would, however, like to underline three aspects of that setting that we feel we must keep in mind.

These three aspects, it seems to me, all have been stated very effectively by the President of the United States on various occasions. The first one is this: The President stated it just about a year ago now, in an address to the nation, when he said, "We are in an age of peril." The second is, "The Soviet now has the capability of attack on us and such capability will increase with the passage of time." That was set forth in a statement issued by the President. The third aspect was set forth in his State of the Union address in January of this year, when he said, "We shall not be aggressors, but we and our allies have and will maintain a massive capability to strike back."

As we keep in mind those three very important aspects of our defense mobilization program, we feel that there are certain specific objectives that we must keep in front of us at all time.

First of all, we feel that we must develop and maintain a strong mobilization base. To us that means we must have available *that combination of facilities, production equipment and skilled workmen, which together with our stockpile of weapons, will enable us to meet rapidly accelerating war-time requirements.* Of course, we feel that a great deal of effort must be placed on the words "rapidly accelerating war-time requirements," because we all believe that should it become necessary for us to move into all-out mobilization, we will not have time on our side as we have in the past.

If we are going to achieve this objective of developing and maintaining a strong mobilization base, there are certain things that we need to do. First of all, of course, we need to know what the gaps are in the mobilization base. I am not going to spend a great deal of time on that. I simply want to say this to you—we feel that more progress has been made in this area possibly than at any other time in the history of mobilization planning. The Defense Department has provided us with the requirements for a thousand major military-end items in the event of all-out mobilization. Those thousand items would account for 80 per cent of our expenditures for military hard goods if we should become involved in all out mobilization. Those items are now being translated into materials requirements and tied in with our defense or war-supporting requirements plus the rock bottom civilian requirements; then, of course, they will be balanced over against supply in order to point up the gaps in our mobilization base.

As you well know, gaps in the mobilization base have been identified. They are set forth, or reflected, in approximately 240 expansion goals that we have kept in mind as we have granted rapid tax amortization certificates and as we have provided other incentives. Around 140 to 150 of those goals have been closed out on the ground that they have been achieved. Approximately ninety goals are still open. We are still doing everything within our power to persuade people to do those things that need to be done if those goals are to be reached, or if those gaps are to be closed.

Those of you who have followed the developments in the field of mobilization planning are very much aware of the fact that some of those goals have been established on the basis of evidence that we would not regard as the best evidence by any means. As we firm up the requirements information from the Department of Defense; as agencies such as Commerce, Interior, Defense Transportation Administration and others provide us with information relative to defense or war-supporting requirements and rock-bottom civilian requirements we are going to put ourselves in a position where our analysis of the gaps in our mobilization base will rest back on a much firmer foundation than has been the case in the past.

Not only do we need to know what those gaps are; we

need programs that will result in filling the gaps. As you know, one of the principal incentives provided by the government has been the incentive of tax amortization. Most of you know that the tax amortization certificates that have been issued up to the present time total around 17½ billion dollars. We are still issuing those tax amortization certificates when applications are made that are related to some of our open goals.

Gaps Exist In Mobilization Base

We are very conscious of the fact that we have some expansion goals that are not going to be reached or some gaps in the mobilization base that are not going to be closed if we simply rely on our existing incentives. So we are analyzing the gaps that haven't yet been closed to determine what kind of specific programs we should present to the Congress, providing in some instances additional incentives in order to make it possible for the nation to close the gaps in the mobilization base.

Not only must we identify the gaps, not only must we have programs to close those gaps; but we must also maintain the mobilization base. Now there has been a lot of discussion about that. Just how, as a nation, we can do something that we haven't done before in our history; namely, maintain a mobilization base once it has been brought into existence. All of us are aware of the fact that as a nation in the past we have been inclined to build up our base in order to deal with an emergency, then when we thought that the emergency had passed we just permitted the base to disintegrate.

I am sure that it is perfectly obvious to all of us that we can't maintain that base solely by relying on the production of items that are needed in connection with a defense or a war program. The production curve as contrasted with the peak after the outbreak of hostilities in Korea is moving down. Of course if the international situation permits it that production curve will continue to move down. That means the production lines will be closed down, plants that have been used for defense production will either be closed or will be utilized for the production of items that are needed in connection with the civilian economy.

We feel that if we are really going to accomplish the objective of maintaining the mobilization base, the government is going to have to be ingenious, enter into contracts with management for the maintenance and modernization, for example, of packages of machine tools, for storing those tools in warehouses near the plants that we use for defense or war production if all-out mobilization became necessary. And, more important than anything else, we will need to enter into contracts that *will insure our retaining on the job, a hard core of management, engineering and skilled personnel that could form the nucleus for a stepped-up production program if that program became necessary*. We believe, although we recognize the problems involved, that contracts of that kind can be entered into between government and management. We believe that in some instances that hard core of management, engineering and skilled personnel could be kept busy a good share of the time on the maintenance and modernization of equipment. In other instances they would only be kept busy a portion of the time. Also they should be available for training so as to be kept up-to-date on current developments in connection with the production of particular items.

We not only are concerned about identifying the gaps in our mobilization base; we are concerned not only about programs designed to fill those gaps; and we are concerned not only about the maintenance of the base, but we are also very much concerned about protecting the base. And, of course, there you can see immediately one of the reasons why we have a very deep-seated interest in our continental defense program. And you can see also why we feel that this industry has a tremendous contribution to make in the direction of providing us with an effective continental defense program so that we, in turn, can really do something practical and realistic about protecting the base. We do have to keep in mind the fact, as the President said last October, that Soviet Russia does have the capability of attack on the United States. That's a fact we must accept in connection with our plans. That's why, of course, we are so very much interested in a dispersal program. Most of you know what those dispersal standards are. There are local dispersion committees in most of the large communities of this nation, made up of representatives of labor, management and the public. These committees work under the Department of Commerce; they identify the areas of industrial and population concentration. Dispersal standards provide that new plants should be located at least ten miles beyond the perimeter of those areas.

It is interesting to note that if you take the projects calling for investments of a million dollars or more, where rapid tax amortization has been granted, over 80 per cent of those facilities have been located in accordance with dispersal standards.

Next, growing out of our interest in the protection of the mobilization base, is our interest in the whole field of protective construction. As you undoubtedly know, we have said that if a business decides to invest in protective construction in a plant that is related to one of our expansion goals and that is located in one of these critical target areas, we will give them a rapid tax amortization on 100 per cent of the capital investment, provided, of course, the protective construction conforms to the standards set by Governor Peterson's engineers.

Not only do we in the Office of Defense Mobilization have a very real interest in the mobilization base—of developing it and maintaining and protecting it—but we also spend a great deal of time in connection with programs designed to make it possible for us to achieve our stockpile objectives. We have seventy-five major strategic and critical materials that are on our stockpile list at the present time. We have virtually reached our goals as far as thirty-eight of those materials are concerned. In the case of about eighteen of the materials on the list we are still in critical shape. As a nation we have already spent $4,200,000,000 putting strategic and critical materials in stockpile; we have $9,000,000,000 on order and in order to reach our minimum stockpile objectives we will spend another $1,800,000,000 to $2,000,000,000. We are determined to meet those stockpile objectives just as rapidly as we can, even though in order to do so it is necessary for us at times to subject the civilian economy to a rather severe strain. We don't know how much time we have on our side. For that reason, we feel that we've got to move just as fast as it is possible for us to move in the direction of reaching our stockpile objective for nickel, to cite an example which has given all of us a great deal of trouble simply because of the fact that the demand for nickel is considerably in excess of the supply.

Continuity of Industry & Government

Of course, not only are we interested in the facilities, equipment, and materials aspects of our mobilization program, we also feel that as a nation we must develop manpower programs to give adequate recognition to the fact that the lack of skilled manpower could be the one limiting factor in the prosecution of a war.

Also we feel in connection with the mobilization program that we must develop programs designed to insure the continuity of industry as well as the continuity of

government. In the Office of Defense Mobilization we spend a great deal of time on the development of programs in those areas. We depend on the operating agencies of the Government, by and large, to carry out those programs. Personally I'm very much encouraged over the fact that through the Industry Division of the Department of Commerce, the industries, particularly the major industries of this nation, are taking a very real and a very vital interest in programs designed to make it possible for industrial operations to continue if an attack should take place on continental United States.

As we have thought in terms of the objectives that we should keep in mind, we have always had uppermost in our mind this objective of having an effective continental defense program and I appreciate the fact that that program divides itself broadly, roughly, into two parts, the military aspects and the non-military aspects. Because the Director of ODM serves as a member of the National Security Council, it has been my privilege to keep up to date on what the military has been doing in the direction of developing a military program designed to give this country an adequate and effective continental defense program.

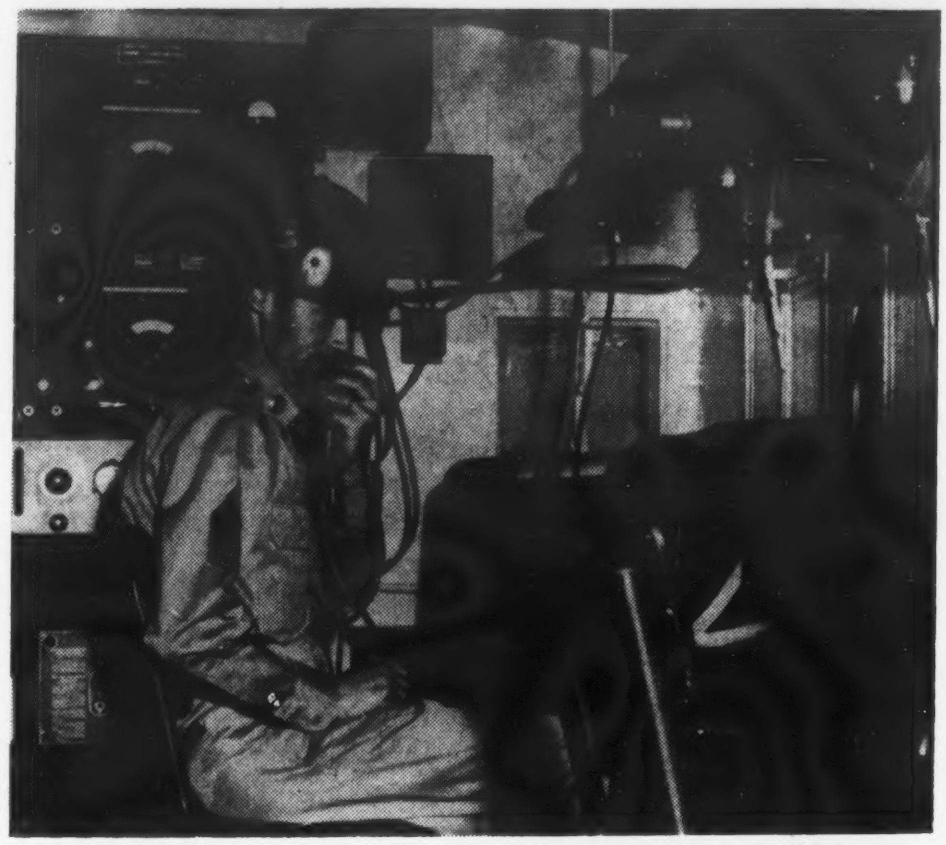
I want to say to you that in my judgment they are doing a tremendously effective job and I also want to say that as far as this administration is concerned, it is determined to do everything that it can to provide the resources that in turn will provide us with an adequate continental defense program. The Defense Department budget for the coming year calls for a considerable increase in expenditures over those planned for this year, although those planned for this year are considerably in excess of three billions of dollars.

But there is also a non-military aspect to the continental defense program. I've already touched on some of these aspects. Governor Peterson at luncheon has touched on some of these aspects as far as the non-military part of the continental defense program is concerned. (See "A Challenge for Defense" by the Honorable Val Peterson, July-August 1954 SIGNAL.)

Telecommunications and ODM

In connection with the continental defense program, all of us in the Office of Defense Mobilization have a very keen appreciation of the role that communications can and must play in the carrying forward of that program as well as other programs directly related to defense mobilization.

In fact, I am sure that that is one of the reasons why the President of the United States, about a year ago, assigned to the Office of Defense Mobilization certain responsibilities in the field of telecommunications. Those of us who have over-all responsibility in the Office believe that we must have a program in the field of telecommunications that will be consistent with and an aid to all of the other objectives to which I have already referred. Under an executive order issued by the President, the Director of ODM is charged with the responsibility of advising and assisting the President concerning his own telecommunications functions. All of you appreciate the fact that the Communications Act of 1934 lodges jurisdiction with the Federal Communications Commission for the regulation of telecommunication operations except those conducted by the Federal Government. That same Act specifically exempts all radio stations owned and operated by the Federal Government from the requirements of the Act and provides that frequencies for such stations shall be assigned by the President. The ODM, of course, is not a radio user and it has no operating responsibility in this area. It functions rather as the staff arm of the President and is the focal point within the Federal Government



The 313th Signal Battalion, attached to the 2nd Army at Ft. Meade, Md., demonstrated field equipment to AFCA members during the tour of the Naval Ordnance Laboratory.

for the resolution of inter-agency policy and technical conflict.

Our telecommunications functions fall into the five following categories:

First, the allocation of radio frequencies to meet current operating requirements;

Next, the reallocation and adjustment of radio frequencies in accordance with the Atlantic City Conference of 1947 and the implementing procedures prescribed by the extraordinary Administrative Radio Conference of 1951;

Third, we have the top responsibility for mobilization planning in this area just as we do in the other areas to which I have referred;

Fourth, we have the responsibility for the coordination of the telecommunication plans and programs of the executive branch of the Government;

And finally, we have certain special tasks and responsibilities that are assigned to us by the National Security Council, which, of course, means assigned to us by the President.

When the executive order was issued transferring the functions of what had been the Office of the Telecommunications Adviser to the President to ODM, I immediately established the position of Assistant Director for Telecommunications in our agency. I invited to come in and serve in that position Mr. William A. Porter, whom many of you know as a person who has had an outstanding experience in this area. I want to say to this group that in my opinion he has done an exceptionally fine job in terms of providing the quality of leadership that is required in a position of this kind. He has associated with him a very small but highly competent staff, two of which served with the President's Communications Policy Board, which, as you know, studied this whole area for a year and issued a comprehensive report in 1951.

As soon as Mr. Porter took over he reactivated the Telecommunications Planning Committee, of which he serves as the Chairman. This Committee is composed of the senior communication officials of those departments and agencies of the Federal Government which are, themselves, users of radio and telecommunication. This Committee has three working panels, one of which is engaged in an assessment of our total telecommunication resources as well as our total requirements under normal conditions.

conditions of a limited emergency and conditions of general war. The second panel is engaged in a study of new methods of communications capabilities of foreign nations.

These panels make recommendations to the Committee, the Committee in turn, of course, makes recommendations to the Director of ODM and in a number of instances our communications are then forwarded along to the National Security Council.

Many of you are also acquainted with the Interdepartmental Radio Advisory Committee. It has been in existence a great many years and by Executive Order it has been transferred to the Office of Defense Mobilization and its activities are under the direction of the Assistant Director for Telecommunications.

The Office of Defense Mobilization recognized that much more can and must be done to improve the nation's ability to manage more efficiently its share of this important world resource. We need a clear, comprehensive up-to-date statement of U. S. telecommunication policy. Wheels have been put into motion designed to achieve that objective. We need to improve our organization and procedure to cope with the complex problems with which we are faced. In this particular area the role of the Office of Defense Mobilization is not to tell the agencies of Government how to carry out their mission but to coordinate their efforts from the standpoint of frequency usage and policy so that our national requirements can be met with due consideration and regard for the relative importance of agency mission and with the utmost consideration to the needs and requirements of private industry. It would be absolutely impossible for us to discharge our duties in the field of defense mobilization without recognizing the tremendously important part that communications has played, is playing, and must continue to play in connection with our total national defense effort. It is absolutely impossible for us to live day in and day out, week in and week out with the nation's mobilization defense problem without a growing recognition of the absolute urgency of providing this nation with an adequate continental defense program. And it is absolutely impossible to give consideration to the urgent need for an adequate continental defense program without recognizing our complete dependence on communications if we are to have that kind of a continental defense program.

I can assure you that as we discharge our responsibilities in the telecommunications area, our chief concern and our only concern is to function as a staff arm of the President in such a way as to insure the fact that this nation makes maximum utilization of the resources and the talent that it has in this particular area and does everything it possibly can to focus those resources on the achievement of the objective of a sound continental defense program.

My friends, we can't live with the information that we have these days without recognizing the fact that our total defense mobilization program must be an on-going program. It must be a program that all of us participate in with a real sense of urgency, and it is a program that, if it is to succeed, must have the complete cooperation of those who are engaged in the kind of activity in which you are engaged at the present time. There is no doubt in my mind but that our defense needs must have a top priority as far as the utilization of our time, our energy and our resources are concerned. I know enough about the cooperation that you and your associates have given the nation in the past, and are giving the nation today, to know that we can count on you without any question at all. May I also say that I also know that there is a tremendous amount of experience represented in this audience. If you have ideas and suggestions as to the way in which we can improve our total mobilization program, or ideas and suggestions as to the things that we can do in this area that will insure the fact that this nation of ours will be dealing with Soviet Russia, not from a position of weakness but from a position of strength, we will welcome your ideas and suggestions, and I invite you to address them to me personally and I can assure you that they will be given very careful consideration.

The Federal Civil Defense Administration

Mr. Peterson

ANY DISCUSSION OF CIVIL DEFENSE AS IT APPLIES TO INDUSTRY includes these nine points:

No. 1. *Industry is the Target.—Plants and people who man them.*

No potential enemy will make the same mistakes as our enemies in the past, namely, to tangle with our military forces and leave our industrial production intact.

Our industrial production centers are particularly vulnerable due to concentrations and interdependence of plants, and we must remember that we can rebuild machinery in a relatively short time but it takes nearly twenty years to create a trained industrial worker.

No. 2. *Survival of Industry and recovery from a devastating attack cannot be left to chance—it is not automatic.*

This point is for the most part an Office of Defense Mobilization responsibility. Bear in mind that survival and recovery of industry under attack conditions will result only from months or even years of planning, preparing plant equipment and personnel for such a disaster, and organizing and training emergency action forces to cope with the effects of such an attack.

In civil defense we wish to stress particularly that activities must include action taken before, during and after an attack, activities which offer positive resistance to effects of blast, fire, and general disarrangement. Above all, it must be coordinated with efforts being taken throughout the nation to alleviate the results of mass destruction weapons on property and people.

No. 3.—*The organization and operation of a civil defense plan within an industrial or commercial establishment follows a well-defined pattern. The details of necessity vary from plant to plant but essential principles are clear.*

There must be effective leadership—responsibility of the owners and operators of these facilities. . . .

Sound business-like preparations of a physical nature to protect people and equipment . . . Dispersal . . . Strengthening of structures, etc. . . .

Organized casualty handling services, trained and equipped to handle multiple injury cases in unprecedented numbers as well as trained rescue teams to release entrapped persons, dead or alive. . . .

Plans for the emergency repair of buildings and machinery, in connection with over-all restoration and rehabilitation plans emanating from government levels. . . .

Systematic coordination of plans for survival within individual plants with those of other plants and above all with those of the community in which the plant is located. . . .

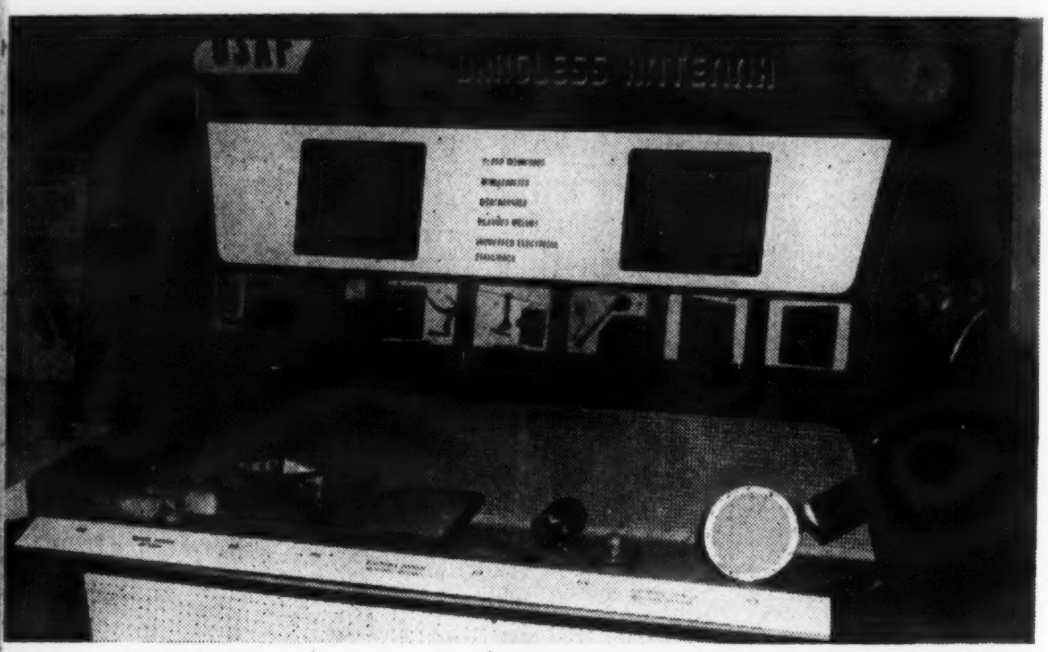
A systematic plan for the preservation of records and other documents essential to the operation of the plant—evidence of title, fiscal records, production records, blueprints, formulae, etc.

It is necessary to remark at this point, that since this country depends upon a well-established credit system for fiscal operations, we cannot permit a breakdown at the plant level of the evidences of credit needed for business continuity after a disaster.

No. 4.—*There are many possible solutions to the problem of individual plants—those faced with the problem at the plant level are in the best position to determine which solution best fits their particular needs.*

Dispersal in civil defense involves advance relocation of industrial and commercial establishments to reduce vulnerability and lessen the advantages to be gained by an attack on the country.

But dispersal is not always feasible. Those who cannot disperse or relocate must be prepared to withstand the



The development and uses of the dragless antenna were explained in this Air Force exhibit.

forces released by modern weapons, to save what can be saved, and get back into production with a minimum of lost time and effort.

The owners and operators of industrial and commercial establishments can best determine the most appropriate solution to their individual defense problems. In an emergency they will be in the best position to carry out the direction of emergency operation calculated to save lives and property. Furthermore, they should recognize the fact that in an emergency they will not be able to rely on the public safety services for protection as their efforts will ordinarily be directed elsewhere. Damage and injuries received under such circumstances must be handled by those already at the scene, IF THEY ARE PREPARED TO HANDLE IT.

Such a solution to the problem is nothing new to industry. Civil Defense in a plant is an extension of normal protective measures, coldly realistic and calculated to handle an increased hazard, of disaster proportions.

No. 5—*Even by the most optimistic estimate, there will never be enough of the resources necessary in terms of both manpower and equipment to meet all of the dangers accompanying an attack upon the country.*

We must pool our resources, both in the preparation and emergency operation stages. Public and private enterprise must become a team in the matter of preparing for the defense of our continent.

We must anticipate the demands of a maximum damage situation and hope for something considerably less, looking for the military defenses to bring this about. In a sense we cannot overestimate our requirements. We could underestimate to our everlasting sorrow.

Our plans must be so complete and so sound that emergency confiscation powers provided for in the FCDA Act, P.L. 920, and again in many of our state civil defense acts, will never have to be invoked.

No. 6—*As a further consideration of the previous point, it is submitted that industrial leaders should be satisfied that those who will have the power to seize and use their equipment and other resources are properly competent to exercise this power in an effective manner.*

There is only one way to insure the existence of such effective organization. Industry must cooperate with public authorities in the development and staffing of effective CD organization and plans for it. In some cases it *may be necessary for industry to assume leadership in establishment of civil defense in their community.*

No. 7.—*There is no magic protective dome which can be lowered over a plant to insure the avoidance of damage to property and injury to personnel.*

Adequate protection will result only from clear thinking, judicious expenditure of time and energy, and above all, full understanding of the problem and the responsibility of management for undertaking its solution.

No. 8—*In the industrial defense picture, as in all of civil defense, there are encountered two attitudes toward Civil Defense; first there are those who will be dependent upon assistance from others in an emergency, largely because they failed to take adequate precautions in advance.*

There are many representative business firms which have faced the problem squarely and undertaken its solution in a realistic manner. There are unfortunately many others who are apparently so preoccupied with production achievement essential to their business that they cannot or WILL NOT find the time or incentive to insure the protection of that business. How many of you realize that the insurance which you carry now will not cover any loss resulting from an enemy attack on this country? How many of you are waiting for the international situation to get worse before you undertake any real emergency planning? How many of you are in this waiting position, realizing in your hearts that this country is seriously threatened and is inviting disaster by such an unwarranted lack of concern with our security?

No. 9—*The effort by the government to create and operate a national system of continental defense suggests a two-fold role to be played by industry:*

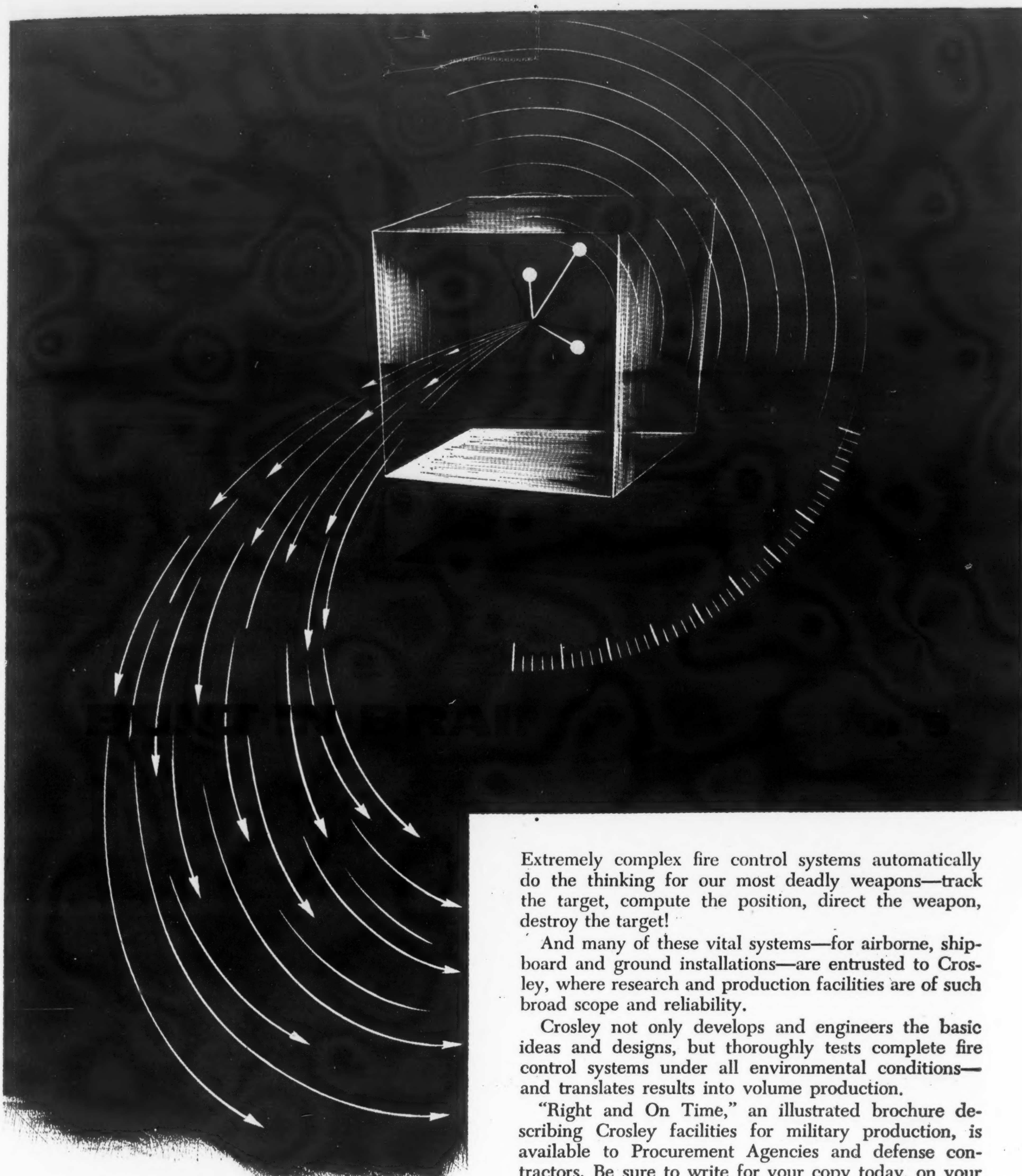
1. Organize and operate an adequate defense program within each plant, coordinated with similar programs of other plants and of the communities in which such plants are located.

2. Call upon your know-how, technical skill, and insatiable mechanical curiosity to devise better ways and means of carrying out the many complex problems which beset the nation's continental defense effort.

Our communications specialists tell me that even without the occurrence of an enemy attack, our presently available means of transmitting emergency messages is somewhat inadequate. There are just not enough telephone, radio or telegraph lines and circuits to take care of all the messages with the speed and accuracy that an emergency demands.

Add to this the fact that an attack on the nation, in accordance with even minimum success based upon our military and civil defense planning assumptions, would

(*Continued on page* 48, *col.* 1)



Extremely complex fire control systems automatically do the thinking for our most deadly weapons—track the target, compute the position, direct the weapon, destroy the target!

And many of these vital systems—for airborne, shipboard and ground installations—are entrusted to Crosley, where research and production facilities are of such broad scope and reliability.

Crosley not only develops and engineers the basic ideas and designs, but thoroughly tests complete fire control systems under all environmental conditions—and translates results into volume production.

"Right and On Time," an illustrated brochure describing Crosley facilities for military production, is available to Procurement Agencies and defense contractors. Be sure to write for your copy today, on your business letterhead.

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CINCINNATI 15, OHIO

ENGINEERS: Constant expansion of long-range research and development contracts in electronics, electro-mechanical devices and fire control systems increases opportunities for highly skilled engineers. Contact our Director of Engineering.

From the President . . .

a salute to the Contributing Editors of SIGNAL

AFCA national president, George W. Bailey, instead of writing his bi-monthly letter to the members, relinquishes the space in order to join the staff of SIGNAL in introducing our contributing editors. An introduction of these men who keep us supplied with editorial material from their various fields is long overdue, but with it goes our sincerest appreciation for their generous support of SIGNAL and the Association. The Editors.

ARMY NEWS

Walter H. McDonald

On July 1st, Mr. McDonald succeeded Bruce Quisenberry as Chief of the Signal Corp's Office of Technical Liaison and replaced him on the staff of SIGNAL. He had previously been active in the AFCA and SIGNAL as head of the Public and Industry Relations Section of the Office of Technical Liaison.

Widely known in public relations and trade association fields, Mr. McDonald held key public relations posts with the American Pharmaceutical Association, the National Paint, Varish and Lacquer Association, the National Canners Association, and, immediately prior to his coming to the Signal Corps, was with the Office of Price Stabilization.

Harold A. Zahl

Dr. Zahl is the Director of Research of the Signal Corps Engineering Laboratories, Fort Monmouth, N. J. He has been associated with the Signal Corps since 1931 and is famous for his contributions in the fields of sound, infrared, electron tubes and radar.

During World War II, he was on active Army duty at SCEL and was awarded the Legion of Merit for contributions made in the fields of vacuum tubes and radar with which he has been associated from its inception.

He returned to the Laboratories as a civilian after the war. This spring, he was awarded the 1954 IRE Harry Diamond Award for his technical contributions, long service and leadership in the Signal Corps' research program.

Dr. Zahl arranged for us to receive the Signal Corps transistor story which appears on page 10 in this issue.

NAVY NEWS

John E. Edwards
Captain, USN

Since his graduation from the U. S. Naval Academy in 1930, Captain Edwards has known a varied and distinguished career in the Navy. Among other assignments before World War II, he studied applied communications at the Postgraduate School, Annapolis. During the war, his commands were the destroyers *USS Phelps* and *USS Brush*. For his gallantry at the Attu Island engagement, while commanding the *Phelps,* Captain Edwards was awarded the Silver Star.

After the war, he reported as assistant to the head of the Communications Department, Postgraduate School, Annapolis, and his other duties, until present, have included assignments as District Intelligence Officer of the 13th Naval District and Commander of the *USS Pickaway*.

He is now Head of the Informational Services and Reserve Liaison Section, Office of the Chief of Naval Operations.

Charles DeVore

A native of Lincoln, Nebraska, Mr. DeVore received his Bachelor of Science degree in electrical engineering from the University of Nebraska. His first editorial experience was as assistant editor of *Electrical World,* a McGraw-Hill publication.

In 1942, Mr. DeVore became a technical editor for the Army Signal Corps and later became chief of the Requirements and Standards Division of the Signal Corps Publications Agency at Fort Monmouth. Since 1950, he has been assistant technical information officer at the Naval Research Laboratory.

A prolific writer for SIGNAL, Mr. DeVore's outstanding articles have received high praise from our readers.

AIR FORCE NEWS

Mario E. Niccolini
Lt. Colonel, USAF

Active in publication functions since 1949, Colonel Niccolini's present activities, in addition to his position with SIGNAL, include: chairman, USAF Communications - Electronics Publications Review Group; secretary, Communications - Electronics Instruction Board (USAF-CEI), and publisher of the Air Force Communications Newsletter, a bimonthly periodical.

Colonel Niccolini was commissioned in the Signal Corps Reserve in 1940 and while in the Army served in various staff communications officer capacities in the European Theater. In 1947 he was integrated into the Air Force and continued his service with operational and staff communications - electronics assignments. He is presently assigned as the Chief, Programs and Standards Branch, Directorate of Communications, USAF.

PHOTO NEWS

Frank Smith

Mr. Smith entered the motion picture field as an electrical technician at the old Biograph Studios in the Bronx, New York in 1926 and remained in this work, later at Vitaphone Studios, Brooklyn, until 1939.

He entered government service in 1940 in a civilian capacity for the Signal Corps and was an instructor at the Philadelphia Signal Supply Schools.

Mr. Smith was a project engineer and technical writer at the Signal Corps Photo Center, Long Island before his transfer to Fort Monmouth as the Chief of the Analysis and Test Section, Photographic Branch, Signal Corps Engineering Laboratories.

Association Affairs

CONVENTION PLANNING BEGUN

The New York and Fort Monmouth Chapters, hosts for the 9th Annual AFCA Convention, have appointed Col. Benjamin H. Oliver, Jr. of the New York Telephone Co. chairman of the national meeting to be held in May, 1955.

Colonel Oliver has announced the selection of the Commodore Hotel in New York as headquarters for the Convention and stated that he already has his committee working on preliminary plans for the program.

General Harper, Active AFCAer, Retires from Air Training Command

Lt. Gen. Robert W. Harper, USAF, retired from the Air Force on June 30th after thirty years of active duty. He had been commander of the Air Training Command since 1948, with headquarters at Scott AFB, Ill.

An honorary charter member of the AFCA Scott-St. Louis Chapter, General Harper's continuous support and able assistance aided in the formation of the chapter and its continued growth in membership.

The AFCA extends to General Harper every good wish on this occasion.

1954 Signal Corps ROTC Camp Award

The association's annual award to the outstanding cadet attending the Signal Corps ROTC Summer Camp was won this year by John S. Crosby of Jacksonville, Florida.

The gold medal and scroll were presented by W. O. McDowell, president of the Augusta-Camp Gordon Chapter, during the camp's final ceremony on July 30th.

This was the second AFCA medal awarded to Mr. Crosby this year. In the spring he won the AFCA award at North Carolina State College of A&E as the outstanding Army ROTC senior majoring in electrical engineering.

John S. Crosby, winner of the AFCA's annual award to the outstanding ROTC cadet attending the Signal Corps ROTC summer encampment.

New Assignments for Generals Ankenbrandt and Garland

The Air Force, in a series of general officer reassignments, has made important changes in major communications-electronics positions.

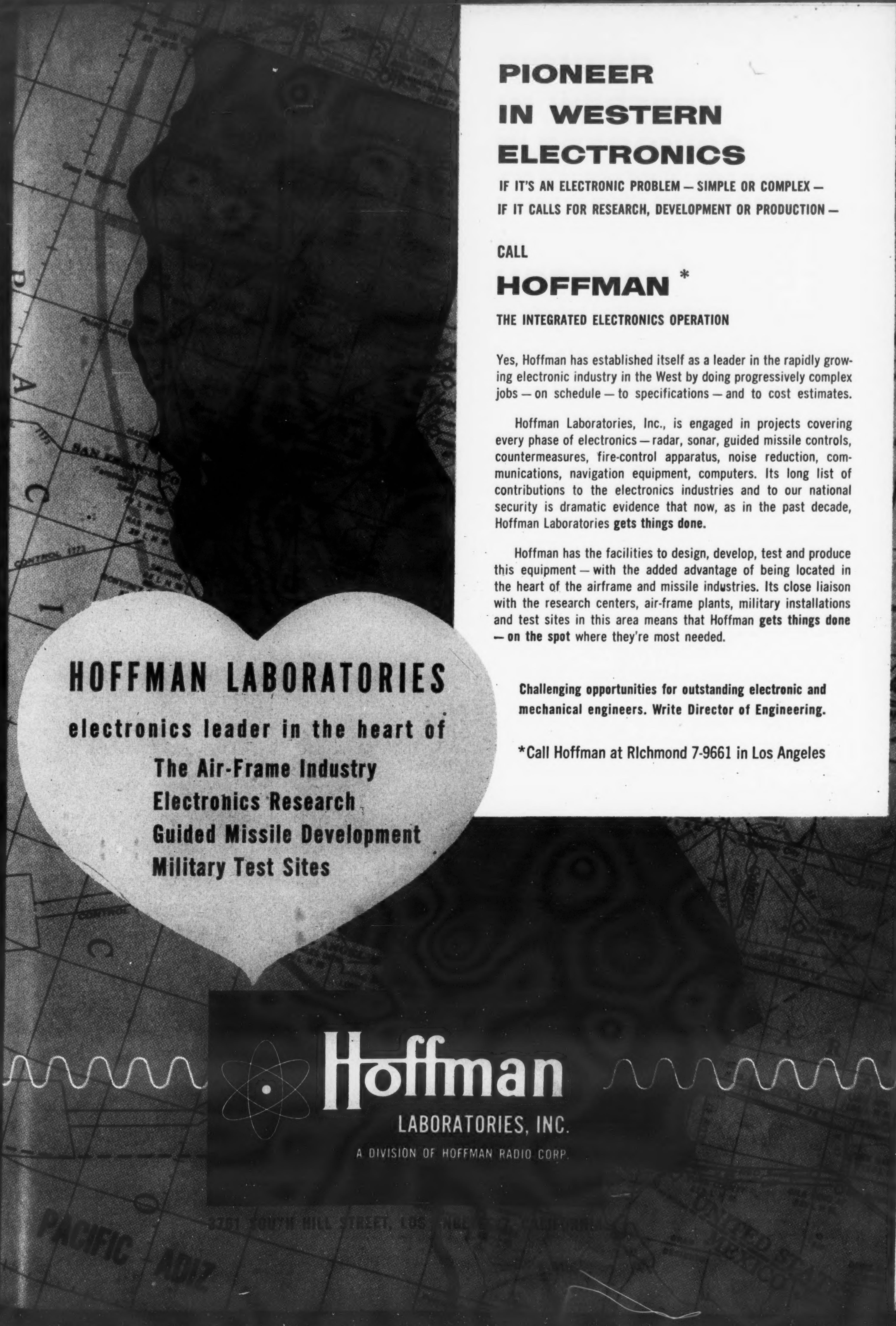
Major General Francis L. Ankenbrandt, USAF, Chief Signal Officer, Supreme Headquarters Allied Powers Europe, will be assigned as the Commander, Airways and Air Communications Service, Headquarters Military Air Transport Service, Andrews AFB, Md.

General Ankenbrandt has been serving as Chief Signal Officer at SHAPE since October 1952. Prior to the SHAPE assignment, he was the Director of Communications, Headquarters U. S. Air Force. He was transferred to France in 1951 as Assistant Chief of Staff for Communications of the Allied Air Forces in Central Europe and subsequently became SHAPE Chief Signal Officer.

Major General E. Blair Garland, USAF, will replace General Ankenbrandt as Chief Signal Officer, SHAPE. General Garland is presently assigned as the Commander of the Airways Communications Service, a position which he has held since September 1951.

Both General Ankenbrandt and General Garland are active members of the AFCA.

At left, Rear Adm. Joseph R. Redman, past national president of the AFCA, awards the AFCA prize at the Naval Academy to George Burton Parks. Below, AFCA National President George Bailey presents the association's award at the Military Academy to Donald Fred Newnham.



PIONEER IN WESTERN ELECTRONICS
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IF IT CALLS FOR RESEARCH, DEVELOPMENT OR PRODUCTION —
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THE INTEGRATED ELECTRONICS OPERATION
Yes, Hoffman has established itself as a leader in the rapidly growing electronic industry in the West by doing progressively complex jobs — on schedule — to specifications — and to cost estimates.
Hoffman Laboratories, Inc., is engaged in projects covering every phase of electronics — radar, sonar, guided missile controls, countermeasures, fire-control apparatus, noise reduction, communications, navigation equipment, computers. Its long list of contributions to the electronics industries and to our national security is dramatic evidence that now, as in the past decade, Hoffman Laboratories gets things done.
Hoffman has the facilities to design, develop, test and produce this equipment — with the added advantage of being located in the heart of the airframe and missile industries. Its close liaison with the research centers, air-frame plants, military installations and test sites in this area means that Hoffman gets things done — on the spot where they're most needed.
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The Air-Frame Industry
Electronics Research
Guided Missile Development
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LABORATORIES, INC.
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PACIFIC
ADIZ

1954 AFCA-ROTC AWARDS

THE AFCA-ROTC AWARD PROGRAM, begun in 1948 when medals were presented at eleven schools, has attracted ever-increasing interest throughout the country, as evidenced by the list of colleges and universities at which the awards were made this year.

The gold medals are now presented to the outstanding senior ROTC, AFROTC and NROTC students majoring in electrical engineering at each college or university participating in the program. In several instances, the local chapter of the AFCA furnishes awards to outstanding underclassmen.

The honor roll of AFCA award winners for the academic year 1953-54 appears below.

A & M College of Texas
Joe B. McAlister, *Army*
William Reed, *Air Force*

Alabama Polytechnic Institute
Robert H. Nunnally, *Army*
Clyde E. Hamilton, *Navy*

Carnegie Institute of Technology
John E. Laynor, *Army*
James D. Meindl, *Army*
(Junior—Chapter Award)

The Citadel
Louis F. Williams, Jr., *Army*
James D. Proctor, *Air Force*

Clarkson College of Technology
William F. Blodgett, *Army*

Clemson Agricultural College
Jones A. Gaillard, *Army*
Philip R. Nickles, *Air Force*

Colorado A & M College
William L. McCarty, *Army*

Columbia University
William Dobbs, *Air Force*

Cornell University
George D. Edwards, *Army*
William L. Simon, *Navy*
Leonard A. Mende, *Air Force*

Dartmouth College
John V. Cernius, *Army*
John D. Musa, *Navy*
Horace F. Taylor III, *Air Force*

Duke University
Leslie F. Chesson, *Navy*

Georgia Institute of Technology
Robert C. Dancy, *Army*
Thomas F. Debnam, Jr., *Air Force*

Iowa State College
Horton R. Potts, *Army*
David T. Friest, *Navy*
Philip Bartleson, *Air Force*

Kansas State College
Jerome L. Hartke, *Army*
William B. Goeckler, *Air Force*

Lehigh University
William P. Whyland, *Air Force*

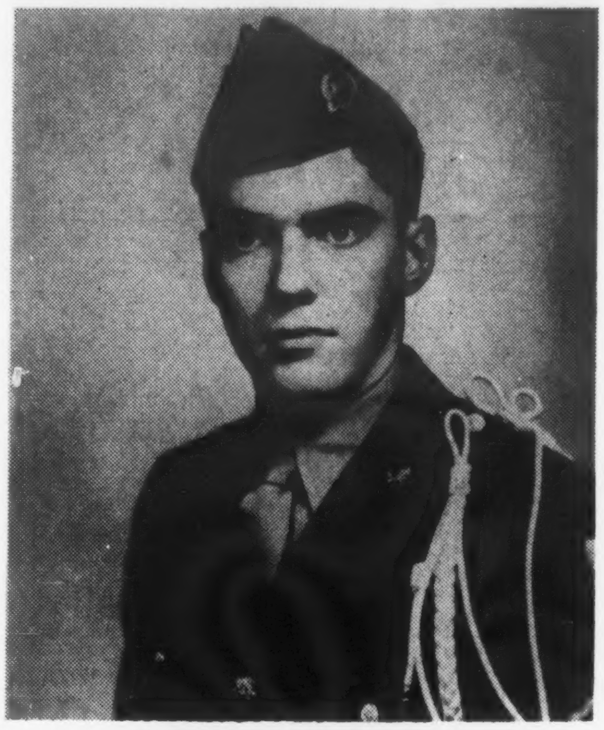
Louisiana State University
Robert A. Peno, *Army*
Donald A. Preston, *Air Force*

Above, Lt. Gen. Withers A. Burress, Commanding General, First Army, presents the AFCA medal to Ulric E. Dennis, New York University.

Below, Brian J. Kelly, Worcester Polytechnic Institute, is congratulated by Lt. Col. Charles F. Harris, PMS&T.

Joseph N. McKenzie being presented the AFCA medal by Dr. Stanley F. Kaiser, Dept. of Engineering, Stanford University.

Marquette University
Thomas A. Shantz, *Navy*
Massachusetts Institute of Technology
William J. Eccles, *Army*
John E. Preschlack, *Air Force*
Michigan College of Mining & Technology
Ronald R. Hocking, *Air Force*
John S. Schnurer, *Army*
Mississippi State College
Charles S. Ferris, Jr., *Air Force*
Newark College of Engineering
Harry Hilsinger, *Air Force*
New Mexico College of A & MA
Lon F. Alexander, *Army*
Richard D. Leger, *Air Force*
New York University
Ulric E. Dennis, *Army*
North Carolina State College
John S. Crosby, *Army*
James B. Walker, *Air Force*
North Dakota Agricultural College
Thomas J. McNellis, *Air Force*
Northeastern University
Paul A. Darois, *Army*
Robert M. Gallant, *Army* (jr.)
Dennis M. Scolamiero, *Army* (soph.)
Northwestern University
George F. Steiner, *Navy*
Norwich University
Gordon S. Dockler, *Army*
Ohio State University
George T. Ruck, *Army*
Oklahoma A & M College
Harold G. Crosby, *Army*
Edward M. Barnes, *Air Force*
Oregon State College
Edwin G. Pearson, *Army*
George A. Hume, *Navy*
Donald R. Chambers, *Air Force*



Charles M. Royal
Texas College of A&I

Pennsylvania State University
Albert N. Kaschok, *Army*
Jackson M. Keim, *Navy*
Bryan C. Troutman, *Air Force*
Pratt Institute
Robert E. Hassett, *Army*
Purdue University
John C. Adams, *Army*
David T. Siems, *Navy*
Donald L. Hofmockel, *Air Force*
Rensselaer Polytechnic Institute
Henry K. Voigt, *Army*
Frank J. Aguilar, *Navy*
Charles R. Holleran, *Air Force*
Rutgers University
George A. Cutsogeorge, *Army*
Donald Z. McGiffney, *Air Force*

Horton R. Potts
Iowa State College

St. Louis University
Francis J. Babka, *Air Force*
Southern Methodist University
John T. Watson, *Air Force*
Southwestern Louisiana Institute
Regis G. Trumps, *Air Force*
Stanford University
Frank S. Young, *Army*
Kenneth E. Lewis, *Navy*
Joseph N. McKenzie, *Air Force*
State College of Washington
Alvin D. Byrne, *Army*
David W. Thomas, *Air Force*
Syracuse University
James H. Denslow, *Army*
Richard H. Bruns, *Air Force*

David C. Duff, UCLA, receiving the award from David E. Jackey, Dean of Applied Arts.

Col. O. J. Mosman, PAS, University of Idaho, congratulates Kenneth D. Wohllaib.

Col. Henry B. Wilson, PAST, Saint Louis University, makes award to Francis J. Babka.

Lt. Col. Charles F. Nowe, PMS&T at Loyola Univ., Chicago, presents the AFCA medal to Phillip V. Lopresti, Univ. of Notre Dame.

Capt. W. B. Epps, PNS, Vanderbilt University, following presentation of medal to Edward J. Woodfin.

John E. Laynor, Carnegie Tech, is congratulated by Adm. J. R. Redman, past national president of AFCA.

Tennessee Polytechnic Institute
William S. Perkins, *Army*
Bobby L. Robinson, *Army* (jr.)
William O. Bandy, *Army* (soph.)
Texas College of Arts & Industries
Charles M. Royal, *Army*
Texas Technological College
James P. McGee, *Army*
Tufts College
Carl F. Raine, *Navy*
Theodore R. Ellis, *Air Force*
Union College & University
George W. Biscoe, *Air Force*
University of Akron
Bruce C. Kent, *Air Force*
University of Alabama
Robert A. Moore, *Army*
University of Arkansas
Jimmy R. Sharp, *Army*
Edward G. Barry, Jr., *Air Force*
University of Buffalo
Robert W. McClure, *Air Force*
University of California (Berkeley)
Mark C. Levy, *Army*
Harold A. Judy, *Navy*
University of California (Los Angeles)
John A. Karsten, *Navy*
David C. Duff, *Air Force*
University of Cincinnati
William C. Arnold, *Air Force*
University of Colorado
Norman J. Brandes, *Navy*
Albert L. Zeman, *Army*
University of Connecticut
Ylo Anson, *Army*
Stephen Altschuler, *Air Force*
University of Delaware
Martin A. Apostolico, *Army*
University of Denver
Marvin F. Anderson, *Army*
Donald E. Rugg, *Air Force*
University of Florida
Edward Bleckner, *Air Force*
University of Idaho
Kenneth D. Wohllaib, *Air Force*
University of Illinois
George E. Hunt, *Army*
University of Kansas
Clark C. Anderson, *Army*
Donald E. Lloyd, *Navy*
Robert L. Lamb, *Air Force*
University of Kentucky
Billy S. Simpson, *Army*
George R. Giles, *Air Force*
University of Louisville
Theodore F. Elbert III, *Navy*
Gerald B. Hollins, *Air Force*
University of Maine
David W. Gates, *Army*
University of Maryland
Wayne A. DeMoss, *Air Force*
University of Massachusetts
Francis B. Bailey, *Army*
University of Miami
Tipton Jennings, *Air Force*
University of Michigan
Robert O. Harger, *Navy*
Vincent Dambrauskas, *Army*
University of Minnesota
Richard W. Soshea, *Army*
Charles I. Malme, *Navy*
University of Missouri
Walter W. Mayfield, *Air Force*
University of Nebraska
William H. Doole, *Air Force*
John A. Marks, *Navy*

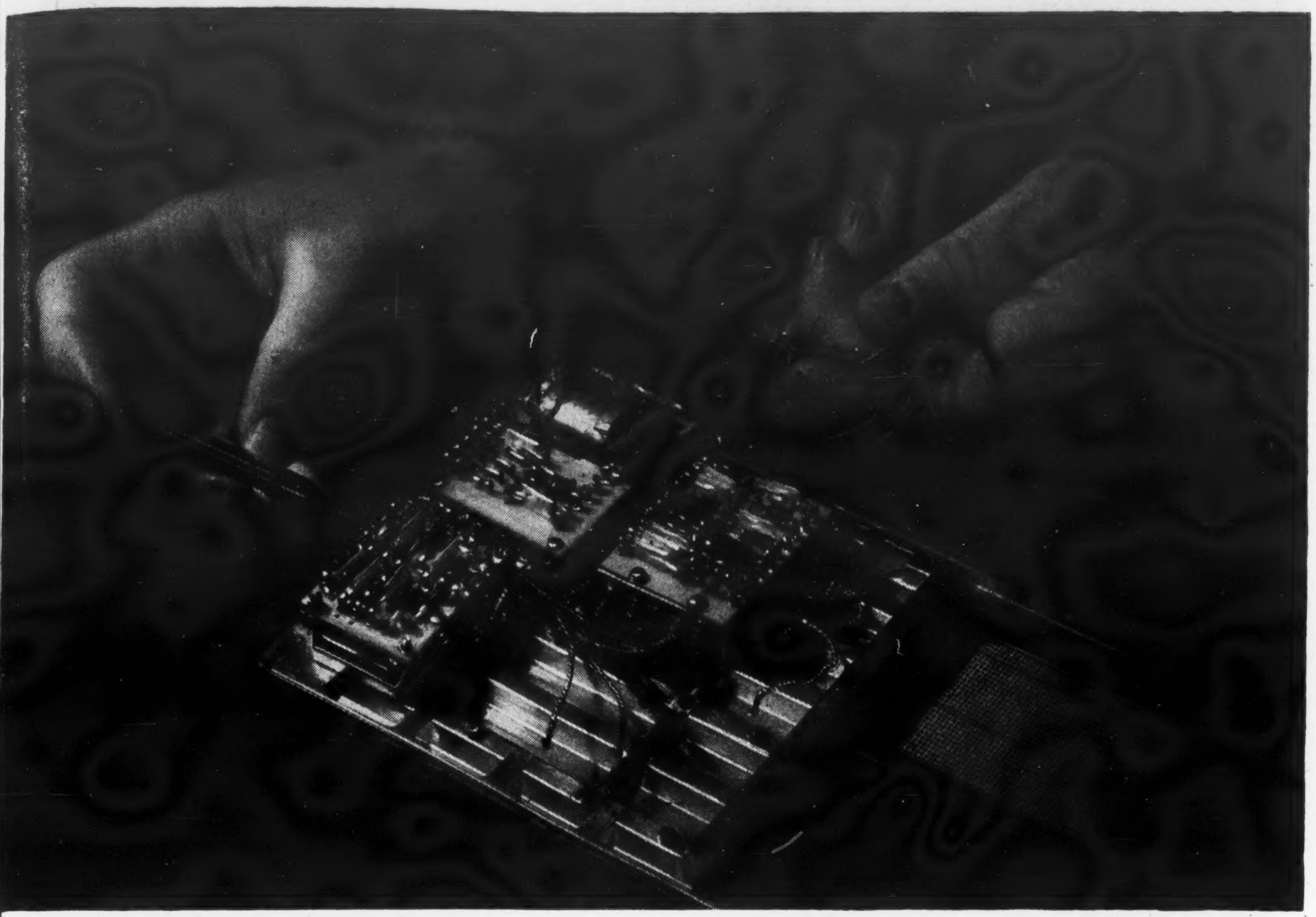
Medals at Cornell University were awarded by Col. George S. Smith, Military Coordinator, to George D. Edwards, Jr. (center) and William L. Simon (right).

University of New Hampshire
Gerald W. McKenzie, *Army*
Henry A. Fraser, *Air Force*
University of Notre Dame
Phillip V. Lopresti, *Army*
James H. Mayer, *Navy*
University of Oklahoma
Elbridge Griffy III, *Air Force*
University of Pennsylvania
Donald N. Ekvall, *Navy*
University of Pittsburgh
Theodore R. Zajac, *Air Force*
University of Puerto Rico
Luis I. Diaz Gandia, *Air Force*
University of South Carolina
Howard O. Casada, Jr., *Navy*
University of Southern California
William L. Sweet, *Navy*
University of Toledo
Robert McGill, *Army*
University of Vermont
Roger C. Chapman, *Air Force*
University of Virginia
Roberdeau W. Wallenborn, *Army*
University of Washington
John B. Dawson, *Navy*
Howard D. Sorensen, *Air Force*
University of Wisconsin
Dean J. Weston, *Army*
Harold R. Leland, *Air Force*
Utah State Agricultural College
Clifford D. Fawcett, *Air Force*
Vanderbilt University
Edward J. Woodfin, *Navy*
Virginia Military Institute
Alvah S. Mattox, Jr., *Air Force*
Virginia Polytechnic Institute
Henry R. Skutt, *Air Force*
Leonce R. Vaughan, *Army*
Washington University
Richard D. Sandefur, *Army*
Wayne University
Harold G. Kimball, *Air Force*
West Virginia University
Delbert R. Parker, *Army*
Gordon R. Williams, *Air Force*
Worcester Polytechnic Institute
Brian J. Kelly, *Army*

Above, Dean Eric A. Walker, Moore School of Engineering, Pennsylvania State University congratulates Albert N. Kaschok.

Col. Jay B. Lovless, PMST, Louisiana State University, pins medal on Robert A. Peno.

Capt. T. H. Tonseth, PNS, Dartmouth College, awards medal to John D. Musa.



David W. Thomas, Washington State College, is congratulated by Maj. Richard F. Knox of the Department of Air Science.

At the University of Kentucky, Billy S. Simpson is awarded the medal by Dean White. Looking on is Col. Rogers, PMS&T.

Symposium on Continental Defense
Mr. Peterson

(*Continued from page* 38)

substantially reduce the capacity of existing message-handling resources. After an attack we face one of the most trying and frustrating situations that the nation has ever been called upon to face. Even assuming that we had the emergency teams, vehicles, medical supplies, fire-fighting equipment, and all the other materials needed to combat the effects of an atomic attack or worse, how would we be able to marshall these resources within stricken cities, between and among groups of stricken areas, across state lines, and even across our international lines, without adequate communications?

There is the matter of our warning system. We should not have to impress upon this audience, the importance of this civil defense measure. But we should tell you, if you are not already aware of it, that its creation has been a serious problem from its start to the present. Even today, with all of the money and engineering that has been poured into this effort, many cities do not find themselves with a fully satisfactory public alerting system. We have a need for better activating and control systems to insure positive warning, free from possibility of mistake or misfire; systems which will reach into the perceptive range of every man, woman and child, including our workers, our families at home, our executive sealed in air-conditioned office buildings. Systems which can reasonably be expected to survive the effects of an attack and remain operative to sound the "all-clear," or even a second warning "red."

We must not overlook the fact that the same destructive forces which will cripple our communications system will also affect our warning devices. In many cities, warning systems are closely tied in with and dependent upon existing communications systems. Some of you may suggest that warnings subsequent to the initial warning "red" can be reliably broadcast using Conelrad facilities, but my communications specialists tell me that unquestionably many of these facilities will also be substantially inoperative in the wake of a well placed nuclear weapon.

I am told that we have a nearly fool proof four-wire circuit for this warning net, designed to overcome ordinary breakdown risk to a large extent. I am also told that this system can be knocked out or seriously impaired even under the most optimistic estimate of damage resulting from an enemy attack.

Gentlemen, we are struggling with these problems. Their solution is vital to our nation's survival. You who live with such matters, day in and day out, must have the capability to seek out positive answers to the riddle.

These are somewhat specialized examples of what we are facing and what we are looking for from the communications and electronics industry. But there are needs for further technical advances in connection with other aspects of the civil defense problem. Medical, welfare, and engineering specialists could undoubtedly fill you in on this subject. To a large extent they have been obliged to deal in realities rather than pursue avenues of research and development into new applications of electronic wonders. We must build our defenses on existing framework. It is suggested that some elaboration of this framework is in order and for this we must turn to you in industry who best understand the capabilities and limitations of your technical storehouse.

Many firms have actively embraced these matters; many more are still to be heard from.

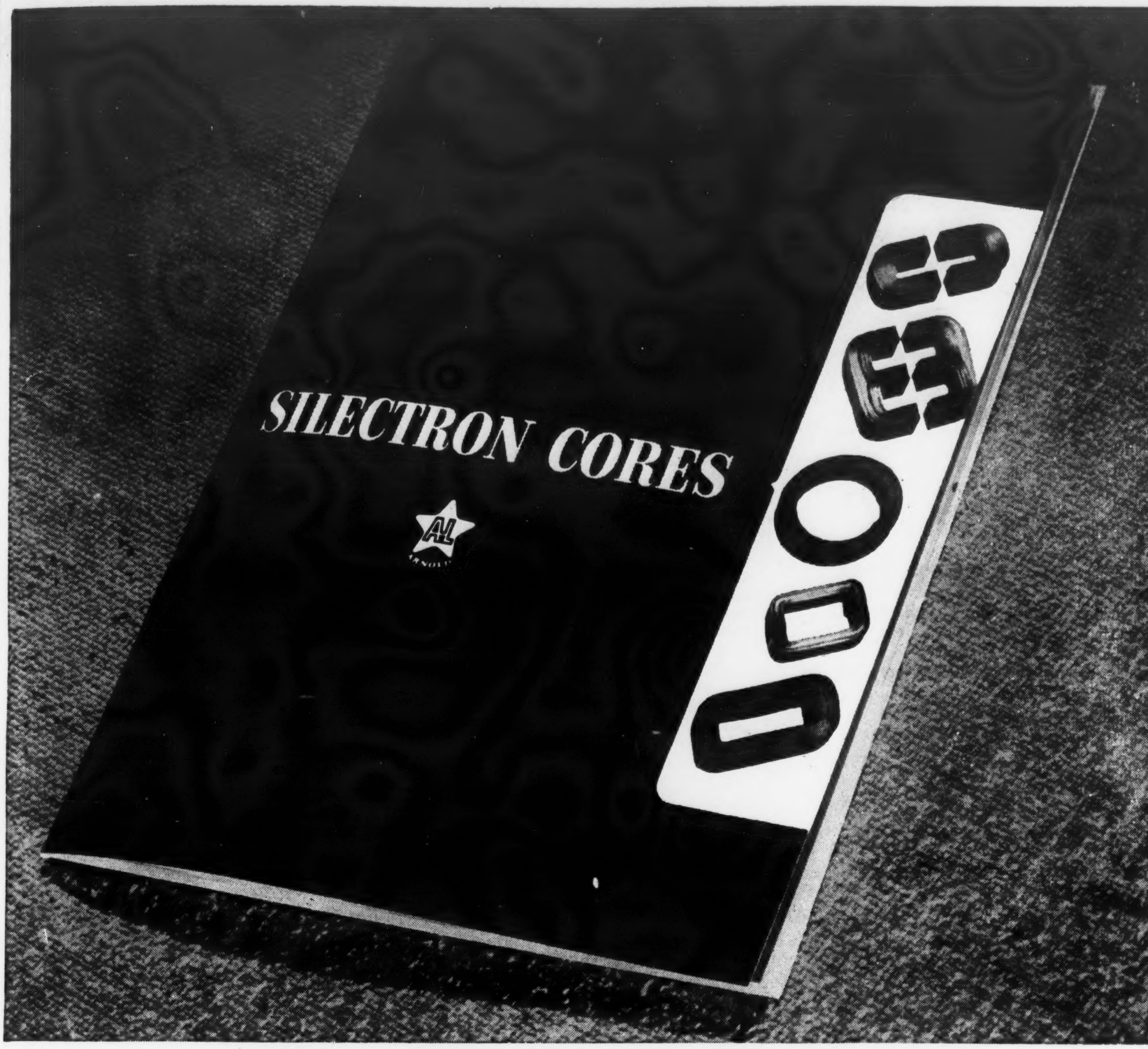
This is clearly the challenge that your government is presenting to you. Will you take the action that is necessary to increase your chances for survival by organizing self-protection programs in your plants, and will you contribute of your technical skill in solving these problems which you alone can adequately dispose of?

Mackay Announces New Marine Radio Direction Finder

A new marine radio direction finder designed to provide greater accuracy and reliability in determining a ship's position has been announced by the Marine Division of Mackay Radio and Telegraph Company, a subsidiary of American Cable & Radio Corporation.

The new direction finder perfected by Mackay engineers is designed to overcome a serious deficiency of the conventional direction finder, whose single-loop antenna is hand-rotated to obtain a bearing, and so is mounted directly above the receiver-indicator in the wheelhouse or chartroom. Although such instruments are calibrated at installation to allow for the deflection of radio waves by the surrounding superstructure, the subsequent alteration of any metallic part of that superstructure—even a cargo boom, stay, or other rigging—may cause appreciable error in the bearings indicated.

The new Mackay direction finder circumvents these errors at their source by making possible the location of the antenna as much as a hundred feet away from the receiver-indicator, with which it is connected by a coaxial cable. This is accomplished by use of a crossed-loop antenna that does not require rotation and so may be located on top of a mast or at any other unobstructed point. It is the first commercial application of the crossed-loop antenna in the United States.


SILECTRON CORES

AFCA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Acme Telectronix
Admiral Corporation
Aircraft Radio Corp.*
Allied Control Co., Inc.
Allied Radio Corporation
Almo Radio Company
American Cable & Radio Corp.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Phenolic Corporation
American Radio Relay League
American Telephone & Telegraph Co.
Ampex Electric Company
Anaconda Wire & Cable Company
A. R. F. Products, Inc.
Argus Cameras, Inc.
Arnold Engineering Company
Atlas Precision Products Co.
Audio Products Corporation
Automatic Electric Company
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.*
Baltimore News Post
Barry Corporation, The
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio
Berkshire Transformer Corp.
Bliley Electric Company
Breeze Corporations, Inc.
Burnell & Company
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capehart-Farnsworth Co.
Capitol Radio Engineering Inst., Inc.
Cargo Packers Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Churchill Cabinet Co.
Cincinnati & Suburban Bell Tel. Co.
Collins Radio Company
Columbus Process Co., Inc.
Copperweld Steel Company
Cornell-Dubilier Electric Corp.
Crosley Division-Avco Mfg. Corp.
Dana, P. A., Inc.
Designers for Industry, Inc.
De Vry Corporation
Diamond State Telephone Co.
Downing Crystal Company
Dukane Corporation
DuMont, Allen B., Laboratories, Inc.
Eastman Kodak Company
Electronic Associates, Inc.
Elgin Metalformers Corporation
Espey Manufacturing Co., Inc.
Federal Mfg. and Engineering Corp.
Federal Telephone & Radio Corp.
General Aniline & Film Corp.
General Cable Corporation
General Communications Co.
General Electric Company
General Telephone Corp.
General Transformer Co.
Gilfillan Bros., Inc.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Guardian Electric Mfg. Co.
Hallicrafters Company, The
Haloid Company
Hammarlund Manufacturing Co., The
Hazeltine Electronics Corp.
Heinemann Electric Company
Hercules Motor Corp.
Hitemp Wires, Inc.
Hoffman Laboratories Incorp.
Hopkins Engineering Co.
Hughes Aircraft Company
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Institute of Radio Engineers
International Business Machines
International Resistance Co.
International Tel. & Tel. Corp.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Kellogg Switchboard & Supply Co.
Keystone Electronics Co.
Kleinschmidt Laboratories, Inc.
Lavoie Laboratories
Leich Sales Corporation
Lenz Electric Manufacturing Co.
Lewyt Corporation
Loral Electronics Corporation
Machlett Laboratories, Inc.
Magnavox Company
Mallory, P. R., & Co., Inc.
Merit Coil and Transformer Corp.
Michigan Bell Telephone Company
The Montgomery Company
Motorola, Inc.
Mountain States Tel. & Tel. Co.
Muter Company, The
National Company, Inc.
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New England Tel. & Tel. Co.
New Jersey Bell Telephone Company
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Northwestern Bell Telephone Co.
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*Company accepted for AFCA Group Membership since last issue of SIGNAL.

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NEW YORK UNIVERSITY, New York, N. Y. President—Cecil R. Frost. Secretary—Edward Abelowitz.

NORTHEASTERN UNIVERSITY, Boston, Mass. President—Fred Hersey. Secretary—Curtis N. Tholander.

NORWICH UNIVERSITY, Northfield, Vt. President—Wilbur Edel. Secretary—William Altman.

UNIVERSITY OF VIRGINIA: Charlottesville, Va. President—Carl B. Caplinger. Secretary — L. Myron Diamondstein.

National Headquarters Chapters Secretary: Julia B. Godfrey

Chapter News

Augusta-Camp Gordon

"Effective Electrical Grounds" was the subject of a lecture-demonstration by Francis A. Saxon of the Georgia Power Company at the chapter's July 15th meeting.

Various charts were used to show the dispersion of currents through grounds under different soil conditions. A practical illustration of this was shown by applying current to a circuit consisting of a light bulb in series with a ground and the surrounding soil, which was dry sand, and then adding a saline solution to the soil. As the soil condition changed the flow of current increased.

Lt. Col. B. L. Avera, chapter vice president, presided over the meeting which followed dinner at Timmerman's Restaurant in Augusta.

At the June meeting, Colonel Wiley, chief of the communications department of the Infantry School, Fort Benning, discussed infantry communications and pointed out that every effort was being made to keep this type of equipment as light and free of gadgets as practicable.

Baltimore

Station WMAR-TV was host to the chapter for a closed circuit showing of color television on May 21st at the Marling House, with a cocktail hour and buffet supper following the program.

High spot of the business meeting was the enthusiastically received announcement that the chapter had been named 1953-54 Chapter of the Year at the recent national convention.

Chapter President George Ruehl expressed the chapter's appreciation to E. K. Jett, president of WMAR-TV, who had arranged the color television presentation. He also thanked Westinghouse Electric Corp. for lending two television receiving sets and WMAR-TV for lending two RCA television receiving sets for the occasion. Attendance was clocked at 175 members and guests.

The final meeting of the season was held at the United States Naval Academy on June 19th. Host for the day's activities was Capt. H. R. Demarest, commanding officer of Naval Radio Stations Annapolis, Cheltenham and Arlington, and a vice president of the chapter. In welcoming the members and guests to Annapolis, Capt. Demarest also expressed his farewell since he was retiring at the end of the month.

After luncheon at Carvel Hall, the group divided into two sections. One went to the Naval Radio Station for a tour and demonstrations in the engineering laboratory and to view the new 800-foot antenna which was recently placed into operation and the other boarded two YP boats for a boat ride around Annapolis harbor.

Among those present were representatives from Westinghouse, the Chesapeake & Potomac Telephone Co., Bendix Radio, Baltimore Signal Depot, Downing Crystal Company, Sperry Gyroscope, Aberdeen Proving Ground, Western Union, Henry O. Berman, Westinghouse Air Arm Division, etc., as well as two Danish Air Force officers.

The chapter's annual elections brought the following into office for 1954-55: president—Donald C. Lee, Westinghouse Electric Corp.; vice-presidents — Henry B. Yarbrough, Bendix Radio Co.; Col. Charles M. Baer, Fort George Meade; Brig. Gen. L. I. Davis, Air Research Development Command; Capt. C. W. Thomas, USCG, Curtis Bay Yard; secretary—Karl H. Keller, Westinghouse Electric; treasurer—Dal Fausnaugh, Bendix Friez Instrument; national council members—John M. Pearce, Phebco, Inc.; Emmett T. Loane, Chesapeake & Potomac Telephone Co.; George C. Ruehl, Jr., retiring chapter president.

Dayton-Wright

The Troy Country Club was the site of an informal get-together on June 26th. Luncheon was followed by golf and swimming, with a gala dinner-meeting concluding the day's activities.

Prizes, donated by Westinghouse, RCA, Sylvania, GE and Raytheon, were awarded to Jack Winters for the best blind poker hand in golf, the longest drive on hole two; to Phyllis Wiley for the highest score in golf; to Carl Graves for driving closest to the cup on hole six; and Mrs. Ralph Root won the door prize. Cash prizes went to Lucille Althoff, Paul Clark, John Harrigan, Ed Lisowski, Art Lord, Jack Kinnally and Jack Winters for sending in reservations with the earliest postmark.

Again taking advantage of summer weather, a combination picnic-business meeting was held at White Oaks Park on July 22nd. During the picnic, an outdoor barbecue was raffled, with James Monk the winner.

Various items of business were discussed, among them ideas for future meetings to increase membership attendance. The consensus of the members was then turned over to the program committee for final decision.

Decatur

Radio Station WSOY was host to the chapter on May 27th. The evening's program included a tour of the station's facilities and a lecture-demonstration on its operations.

During the business session, a detailed report on the proceedings of the recent national AFCA convention in Washington was given by David Richardson, chapter secretary.

Fort Monmouth

Prior to leaving his post as Commandant of the Signal School, Brig. Gen. Wesley T. Guest was awarded a certificate of appreciation from the Fort Monmouth Chapter for his outstanding support throughout his stay at Fort Monmouth.

The presentation was made by Chapter President Paul Langguth on June 16th, with the following chapter officials present: Adm. Andrew Sheppard, first vice-president; Felix Celli, secretary; and Col. Joseph E. Heinrich, director and past president.

General Guest's new assignment is Chief Signal Officer, USAREUR.

Hawaii

Capt. Richard E. Elliott, USN, has been elected president of the Hawaii Chapter for 1954-55, with Lt. Cdr. Charles E. Ross as chapter secretary.

The other new officers chosen during the recent annual election are: vice presidents — Louis W. Robello, Hawaiian Telephone Company; Lt. Col. G. R. Charlton, USAF; Lt. Col. R. T. Bucy, USA; treasurer—Mrs. Dora J. Posey, Hawaiian Telephone Co.

Committee chairmen have been appointed as follows: membership—Maj. Thomas L. Redd, Jr., SigDiv, USARPAC; national security and liaison—Col. Cornelius McBrayer, CINCPAC Hqs.; program and publicity — William C. Kea, Hawaiian Telephone Co.; finance—Col. Bucy.

ondon

A business meeting was held on ne 2nd at the home of Maj. George arak, chapter secretary. The pro-sed constitution and by-laws was viewed and it was recommended at it be sent to national AFCA head-arters and to all London Chapter embers for approval.

The following committee chairmen re elected to cover the various ases of chapter operation: mem-rship—Maj. C. A. Wintermeyer, SAF; program—Romney E. Wheel-r, NBC; finance—Capt. H. P. Rum-le, USN.

Plans for the first fall meeting were scussed and suggestions as to the pe of meeting, speaker and subject ere passed on to the program com-ittee.

ouisiana

Distinguished guests of the chap-r at its June meeting (reported in evious issue) were: Ray Samuel, esident of the Navy League of uisiana; Rear Adm. T. J. Ryan, SN (Ret.), formerly in charge of e Naval Reserve activity of the 8th val District; Mr. Slaughter repre-nting Col. Tench of the U. S. Engi-ers; James C. Kraus, past president the Y.M.B.C., representing the Se-tive Service Board; Col. S. P. Hub-rd, president of the Reserve Offi-rs Association; Col. Sol Bloodworth, presenting the Louisiana Military strict; Col. P. A. Dayries, Asst. perintendent of Police; Capt. nchcomb, executive officer, repre-nting Capt. F. A. Leamy, command-8th Coast Guard District; Dr. J. Keller, D.D.S.; Dr. Lloyd Eyrichs, D.; and General H. A. Duffie, com-nder, New Orleans Port of Em-rkation.

ew York

New York Chapter members, their ies and guests, attended a picnic at vernors Island (headquarters of rst Army) on June 30th.

This annual affair was organized by Col. Frank Kidwell, First Army Signal Officer and vice president of the chapter, who welcomed the AFCA members and guests on behalf of the First Army. Everyone enjoyed the excellent chicken dinner, served in picnic style, together with plenty of refreshments, ice cream, etc. There was outdoor dancing, the music for which was furnished by an orchestra composed of members of the First Army Band.

The occasion was also the farewell for Col. Kidwell who retired from active Army service the end of July. Admiral Walter S. Anderson, chapter president, expressed the best wishes of the chapter to Col. Kidwell in his retirement and thanked him for his efforts and those of his staff in making the picnic such an enjoyable occasion. He also expressed the sincere appreciation of the New York Chapter to General Burress, Commanding General, First Army, for his courtesy in making the picnic possible.

This was the chapter's last meeting until the fall, and it was an ideal day and evening for the more than 175 members and guests who attended the affair.

North Texas

A tour of the USAF Plan 51 switching center, a Western Union installation, at Carswell Air Force Base, was the feature of the chapter's third regular meeting held June 10th. The tour was conducted by Air Force communications officers who explained the various operations of the switching system.

Among the new members introduced and welcomed into the chapter were representatives from Texas Instruments, Inc., a new group member. A guest at the meeting was Howard Davenport, vice president of the South Texas Chapter, who extended a cordial invitation to all present to visit the South Texas Chapter whenever possible.

A film on atomic bomb explosions, their effects and medical aspects, was shown at the July 23rd meeting at the Naval Air Station in Dallas. Col. T. F. Yates, chapter director, made arrangements for the program and also conducted a question and answer period at its close.

Vice-president T. F. Byrnes presided over the meeting in the absence of President Manning who was on vacation.

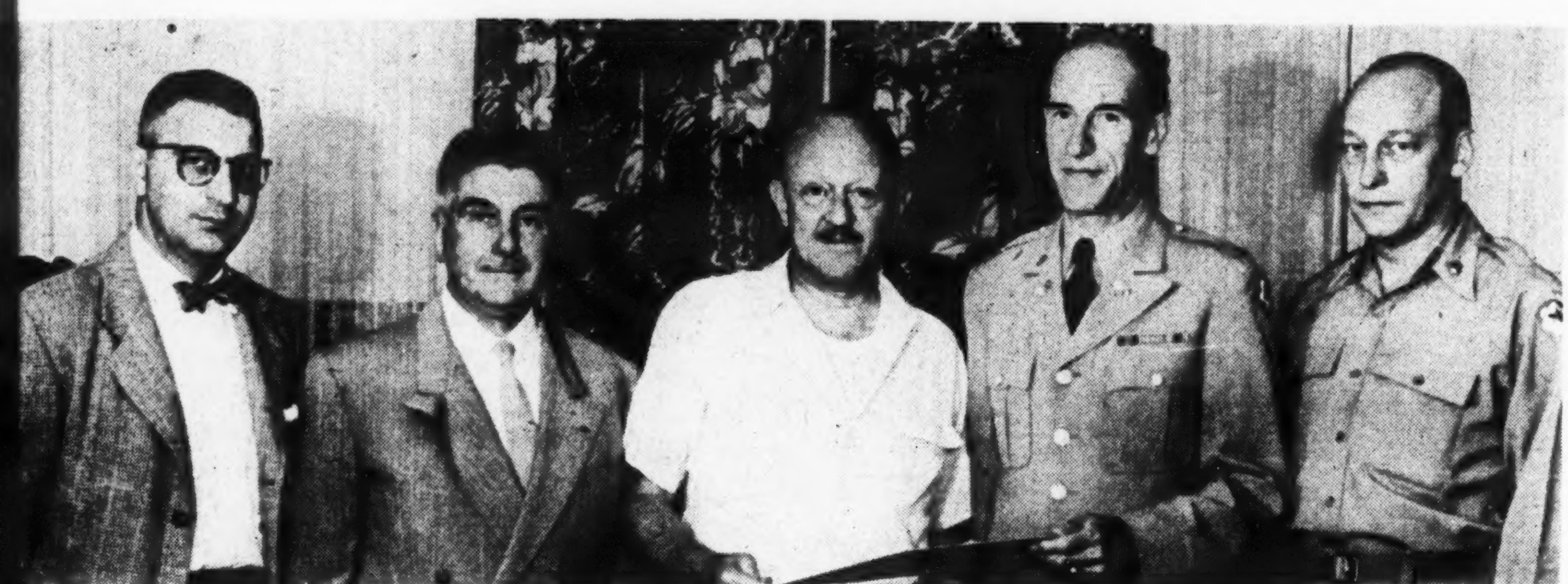
Paris

M. Phillipps Lizon, president of the Syndicate of Electronic Industries in France, was the principal speaker at the chapter's mid-summer meeting at Orley Field Officers Club on July 19th.

The meeting was also the occasion for the chapter's farewell to Maj. Gen. F. L. Ankenbrandt, Chief Signal Officer, Allied Command Europe, who was being transferred to the States. Chapter President Arian de Goede paid tribute to General Ankenbrandt for his efforts in organizing the Paris Chapter and in contributing to its success. General Ankenbrandt responded with a final message to the chapter and was given an ovation which expressed the best wishes of all those present.

In his address, Mr. Lizon took the entire membership on an imaginary flight from Orly Field, Paris, to La Guardia, New York, during which he explained, in layman's language, all of the intricacies of modern day air navigation devices and their operation in day to day air travel.

Approximately ninety members and their guests were in attendance, with the Fontainebleau delegation reaping the honors for the greatest number present, distance considered. The meeting was preceded by an enjoyable cocktail hour during which many old friends exchanged greetings and new members and guests from the U. S. European Command Headquarters were made welcome.



Fort Monmouth Chapter award presentation to Brig. Gen. Wesley T. Guest. Left to right: Felix Celli, chapter secretary; Rear Adm. Andrew Sheppard, first vice president; General Guest; Col. Paul Langguth, president; and Col. J. E. Heinrich, past president.

Louisiana Chapter dinner-meeting at the Officers Club, Camp LeRoy Johnson on June 10th, featured a lecture-demonstration on recent developments in military radio.

Peninsula

Application for charter for the Peninsula (Va.) Chapter was received and approved at national headquarters on July 22nd. Included in the area of the new chapter are Langley AFB, Fort Monroe, Fort Eustis, Newport News, Warwick, Hampton, etc.

Temporary officers have been chosen as follows: president—Brig. Gen. Paul L. Neal, Signal Officer, Army Field Forces, Fort Monroe; vice-presidents—Col. Harold G. Hayes; Col. Robert F. Frost, Hq. TAC,, Langley AFB; secretary; Leo F. Zakowski, Philco group supervisor, DCS/Communications, Langley AFB; treasurer—Lt. Col. Warren M. White, Hq. TAC, Langley AFB.

Philadelphia

Russell E. Cramer, Jr., vice president of the Radio Condenser Co., has been elected president of the Philadelphia Chapter for 1954-55.

Other officers chosen during the recent annual elections are: vice-presidents—J. P. Barkow, RCA; Brig. Gen. J. S. Willis, SigC; Col. D. L. Rundquist, AF; J. P. McLean, Philco Corp.; William F. Powell, Jr., Bell Telephone Co.; secretary—Tom Armstrong, Radio Condenser Co.; treasurer—J. R. Curley, International Resistance Co.

Pittsburgh

The chapter's annual banquet was held on May 20th in the grand ballroom of the Hotel William Penn. The principal speaker was Col. J. Harry LaBrum, national AFCA director, who discussed the vital importance of civil defense and emphasized the lack of adequate preparation on local and national levels. Rear Adm. Joseph R. Redman, USN (ret.), past national president of the association, was a special guest and gave a brief talk on AFCA affairs.

President Sam Phillips welcomed the 190 members and guests present and then announced the results of the annual elections as follows: president—E. W. Breisch, Union Switch & Signal Div., Westinghouse Air-brake Co.; vice-presidents — G. E. Aderhold, Saxonburg Ceramic & Manufacturing Co.; W. W. Ege, Copperweld Steel Co.; W. C. St. Clair, Bell Telephone Co.; Capt. H. R. Smith, Carnegie Institute of Technology; secretary—Harry W. Shepard, Jr., Stanwix Autoparks & Garages; treasurer—W. H. Yates, Western Union Telegraph Co.; directors — H. W. Mitchell, Bell Telephone Co.; F. E. Leib, Copperweld Steel Co.; F. E. Moran, Western Union; S. E. Phillips, Bell Telephone; S. H. Stupakoff, Stupakoff Ceramic & Manufacturing Co.; Dr. J. A. Hutcheson, Westinghouse Electric; A. M. Crawford, Pennsylvania Railroad; W. W. Werner, RCA Service Co., Inc.; R. W. Will, Hamburg Bros.; E. J. Staubitz, consulting engineer; J. D. Meindle, Carnegie Tech student section; and R. Baridon, United States Steel Corp.

President-elect Breisch touched on future plans for the chapter and commended the outgoing officers for their fine leadership during the past year.

Door prizes were distributed during the evening, and dinner music was provided by the Joe Schafer Trio.

Seattle

Chapter members met on June 9th at the Bow Lake (Seattle-Tacoma) Airport for a tour of the Pan American Airways facilities. Host for the evening was Joe E. Gregory of Pan American who first presented an unusual color film (PAA), "Fishing in South America," which showed some fabulous fresh and salt water fishing.

Mr. Gregory then conducted the group through the weather bureau, the control tower, the PAA facilities and a number of airplanes of the various types operated by Pan American. In the weather bureau, the procedures for assembling reports and other data for preparation of weather forecasts were explained. During the visit to the control tower the AFCA members were able to observe actual operations for a period of time.

The group also toured the Pan American kitchens, shops and hangar. Various Douglas planes and a Boeing Stratocruiser were inspected, with the cockpits and radio equipment proving of special interest.

A social hour and dinner in the International Room of the Airport preceded the evening's program.

South Carolina

James S. Bonner, General Coordinator of Civil Defense for the Southern Bell Telephone & Telegraph Company in Atlanta, was guest speaker at a dinner-meeting of the chapter on August 3rd. He discussed communications used in the defense of the continental United States, and demonstrated a model of equipment used to disseminate warnings from air defense control centers to key point warning centers and then to key points in each state.

Among the seventy-five members and guests present were Maj. Gen. Dozier, Adjutant General of South Carolina and State Director of Civil Defense; Col. Tibbetts, Commanding Officer of Shaw Air Force Base, together with representatives of their organizations. Major Work, Signal Officer at Fort Jackson; Commander Allen, Communications Officer of the Sixth Naval District; Captain Sutton, Communications Officer, Charleston Air Force Base; and Lieutenant Feaster, Communications Officer, U. S. Minecraft Fleet, Charleston, represented the commanding officers of their installations.

Southern California

Principal speaker at the chapter's June 22nd meeting was H. L. Hoffman, president of Hoffman Laboratories, Inc., who gave a brief background of what has happened on the Pacific Coast in the electronics industry during the past few years and emphasized the importance of maintaining a high degree of ingenuity and determination in the ever-increasing competitive field.

As chairman of the electronics committee of the Los Angeles Chamber of Commerce, Mr. Hoffman explained the aims of the committee and bore out the fact that its activi

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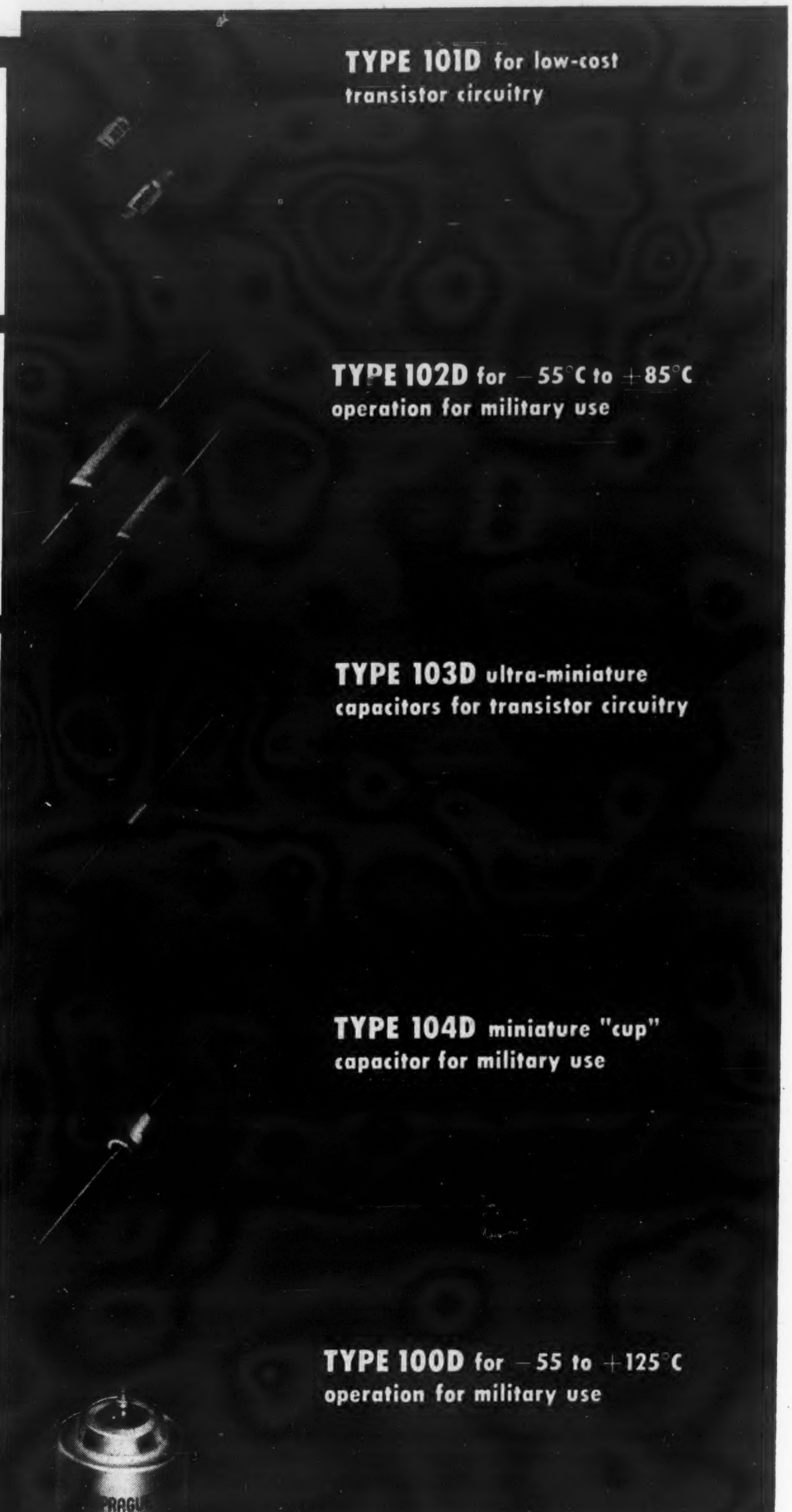
Looking for tantalum electrolytic capacitors? You'll save time and trouble by checking Sprague's complete selection *first.* Sprague makes more types of tantalum capacitors than *any other manufacturer.*

Sprague Tantalex capacitors provide maximum capacitance in minimum space . . . exhibit no shelf aging under long testing periods . . . have extremely low leakage current. And most important, they give unusually *stable* performance, because they're made with tantalum, the most stable of all anodic film-forming materials.

There's a complete range of sizes and ratings available in Tantalex capacitors . . . from the ultra-miniature 10 mf, 4 volt unit in a case only ⅛" in diameter by 5/16" long . . . to the 7 mf, 630 volt unit in a case 1⅛" in diameter by 2 19/32" long. As for case styles, Sprague makes them all, from tiny tubular and cup units to the large cylindrical types.

For complete details relating to your miniaturization or high temperature problems, write Sprague Electric Co., 287 Marshall St., North Adams, Mass.

Sprague, on request, will provide you with complete application engineering service for optimum results in the use of tantalum capacitors.



SPRAGUE

...LD'S LARGEST CAPACITOR MANUFACTURER

*Trademark

Export for the Americas: Sprague Electric International Ltd., North Adams, Mass. CABLE: SPREXINT

ties in no way would conflict with any of the existing industry organizations but rather would supply these organizations with much needed information. He also pointed out that Southern California is a leader in the field of rockets, computers, and guided missiles, and that many people in the universities on the Pacific Coast are receiving national recognition. He stated, as an example, that the influx of instrument manufacturing concerns in the Pasadena area is probably due largely to the close proximity of California Tech.

Pointing toward further expansion of industry on the Pacific Coast, Mr. Hoffman advised that the Atomic Energy Commission had requested private companies to enter into research and development work in the atomic field as to its application in agriculture, medicine, and power development.

During the business session, the temporary officers (listed in previous issue of SIGNAL) who had been heading the chapter since its reorganization were officially elected to serve for the year 1954-55. In addition, Adm. T. F. Wellings and John Aalberg were elected to represent the chapter on the national council.

Southern Connecticut

The chapter held its final meeting of the season on June 17th at the Wonder Bar Restaurant in Bridgeport. A social hour and dinner preceded the meeting at which President Edgar Love reported on the events of the national ACFA convention and also summarized the progress made by the Southern Connecticut Chapter during its first year of existence.

South Texas

Brig. Gen. James L. Cooney, Commandant of the Medical Field Service School, was the featured speaker at the chapters' June 1st meeting.

A recognized authority on atomic medicine, General Cooney presented an extremely interesting and timely talk, tracing the use of radiation, good and bad, throughout the history of medicine up to the present. He described the present use of radioactive isotopes in medicine and discussed some of his experiences and observations regarding the effects of atomic explosions. Emphasizing that the end result of exposure to excessive radiation may lead to the development of cancer, he stressed the need for prompt action after such an explosion.

In conclusion, General Cooney expressed the hope that a feeling of respect, instead of fear, be developed and that, with the utilization of necessary precautions, man might begin to understand the mighty forces he was dealing with.

The meeting was held at the Fourth Army Officers Club, Fort Sam Houston. Dr. Bieverdorf, a noted mycologist presently associated with the Southwest Research Institute, was introduced as a special guest.

Photogrammetry was highlighted at the July 27th meeting by Marshall S. Wright, Jr., engineering consultant with Jack Amann Photogrammetric Engineers, international aerial survey map makers.

Mr. Wright opened with a brief historical sketch of photogrammetry, the art or science of obtaining reliable measurements by means of photography. He described the various processes involved and techniques used in utilizing photography in the making of both topographic and mosaic maps from start to finish, beginning with the selected area, the choice of proper picture and flying weather, the taking of an original series of pictures, effecting necessary corrections, reproducing, sketching in necessary detail lines such as contour lines, etc., to reproduction of finished item. (*See feature article, page* 19.)

The talk was illustrated throughout with appropriate slides. At its conclusion, Mr. Wright conducted a question and answer period, and also extended an invitation to chapter members to visit the plant and further acquaint themselves with the photogrammetric art.

Distinguished guests were Maj. Gen. Haydon L. Boatner, Deputy Army Commander, Fourth Army, and Col. Martin L. Crimmins, Vice-President of the West Texas Historical Society, who was recently awarded the Walter Reed Award for his extensive studies of rattlesnake venom.

Tinker-Oklahoma City

Lew Chatham, Civil Defense Coordinator for the State of Oklahoma, addressed the July 30th meeting on the need for Civil Defense and what might be expected of the civil population of the state.

The film, "Operation Ivy," a 28-minute color presentation, was shown at the conclusion of the talk.

A tour of the Shawnee plant of Sylvania Electric Products, Inc., was the feature of the chapter's June 25th meeting. The members and guests were escorted through the plant, which is geared for electronic receiving tubes, by several members of the Sylvania staff, and were shown step by step processes in the assembly of vacuum tubes.

The plant is almost completely air-conditioned, which made the two-hour tour pleasant as well as interesting. The chapter's appreciation for the excellent program was expressed to C. W. Hosterman, plant manager, by Brig. Gen. Thomas Bryan, chapter president.

Southern California Chapter's June 22nd meeting was addressed by H. L. Hoffman, president of Hoffman Laboratories, Inc. Shown above is a partial view of the members and guests in attendance. In the standing group at the right are (l to r): Larry LaHar, vice president; Adm. Charles F. Horne, director; Mr. Hoffman; Richard Fuller, president; Adm. Timothy F. Wellings, national council member; and Lester R. Daniels, secretary-treasurer.

NEWS

Communications-Electronics-Photography

G-E TOOLS FOR MASS PRODUCTION OF TRANSISTORS

The General Electric Company announced recently that it is tooling for mass production—in the millions—of low cost, exceptionally high frequency transistors.

Dr. W. R. G. Baker, G-E vice president and general manager of the company's Electronics Division, said that plans for large quantity production of the transistors have been made possible through the development of a "rate grown" method of mass producing essential transistor elements.

The complete transistorization of radio and television receivers has not been practical before, he said, because manufacturing difficulties with transistors, capable of replacing all the tubes in radio and television receivers, have kept the price of such devices at an extremely high level.

Initially, rate-grown transistors are being used in military equipment where their extremely high frequency, size, weight and dependability are of prime importance.

Dr. Baker further stated that as a result of the huge quantities of uniform transistor elements it is now possible to produce by the rate-grown process, prices of the transistors should become competitive with vacuum tubes.

Dr. Robert N. Hall, inventor of the new method of mass producing the essential elements of transistors, found that it was possible to produce the necessary elements in large quantities—several thousand at a time—from the germanium refining process itself. His method involves introducing special impurities, gallium and antimony, and varying the heat controls during the refining process. By this method, as many as 100 wafer-thin layers of specially treated germanium are formed.

The ingot is then diced into bars, each several thousandths of an inch long, with a layer through the center. The layer in the center of the bar does the work of a grid. The sections of the transistor bar on either side of the layer take the place of the cathode and plate in a tube.

Using the new method, several thousand transistors can be produced from the yield of each ingot.

A remarkable feature of the rate-growing process is that conditions of single-crystal germanium growth can be varied so that transistor bars having optimum operating characteristics can be obtained at will and in quantities of thousands at a time.

The basic research, development, and product refinement work was carried on under a joint Army-Navy-Air Force contract administered by the Air Force.

AEC Encourages Unclassified Research on Uranium

Until recently, most research on the metallurgy of uranium and its alloys has been done at the major Atomic Energy Commission laboratories under the usual security conditions. However, it is not generally realized that there are many fundamental research projects that can be performed on an unclassified basis.

Work may be carried out under these general principles: First, any subject for research must have the approval of the AEC's Office of Classification, and a license must be obtained for purchase of natural uranium if more than three pounds are to be used. The metal is unclassified, however, and need only be accounted for on the basis of its monetary value.

Second, a project leader must generally be given a security clearance so that he may learn what information might be classified and be able to recognize and secure classified information should it unexpectedly be developed.

Third, technical reports, although nominally unclassified, must be reviewed by AEC before publication. In the past, delays or deletions as a result of such review are exceedingly rare.

The AEC has indicated willingness to provide financial support (as funds are available) to worthy research projects, or to provide necessary small amounts of natural uranium free of charge in return for information developed. Further inquiry should be made to the Atomic Energy Commission, Division of Research, Washington 25, D. C.

Bell Labs and Western Electric Announce Multi-Channel Radio Relay

A multi-channel field communication radio relay which links points 25 or 30 miles apart is now being delivered for extensive military use, the Army Signal Corps and the Western Electric Company recently announced.

The equipment, similar in principle to that used in the Bell System's microwave radio relay systems, was developed by the Bell Telephone Laboratories and is being manufactured by Western Electric.

Designated radio set AN/TRC-24, the unit consists of complete transmitter and receiver components, from power source to antenna, and carries spare parts for emergency and maintenance purposes. It provides FM

(Continued on page 62)

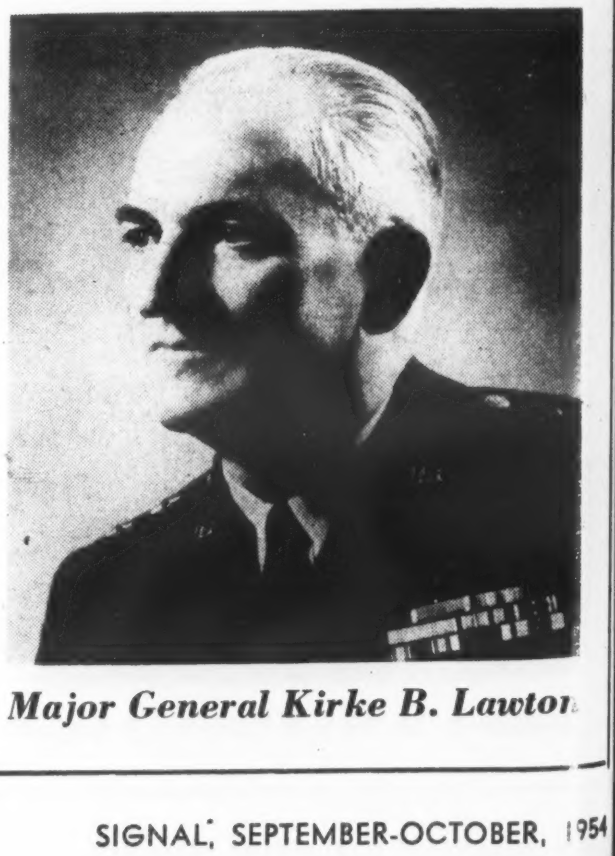
General Lawton Retires

Farewell honors for Maj. Gen. Kirke B. Lawton, Fort Monmouth commanding general since December, 1951, were held on August 28th with a formal garrison review at Fort Monmouth.

Heading the list of Army dignitaries attending the ceremonies was Maj. Gen. George I. Back, Army Chief Signal Officer.

During his 37 years of Army service, General Lawton, prior to assignment at Fort Monmouth, was Deputy Chief Signal Officer for over three years.

General Lawton, long active in AFCA activities, is a National Director of the Association.



Major General Kirke B. Lawton

transmitting and receiving facilities in the area of 100 to 400 megacycles, for line-of-sight relay of a broadband signal of 250 to 68,000 cycles per second.

The set is generally employed with four or 12-channel carrier truck systems using spiral four cable connections. Readily portable when packaged in transit cases, the unit is designed to operate continuously under all types of climatic conditions.

New Porous Carbon is 75% Air

A new, highly porous yet extremely fine grain carbon developed by the Stackpole Carbon Company, St. Marys, Pa. is 75% air yet retains the usual desirable carbon characteristics such as high electrical conductivity, resistance to chemical attack, and stability under high temperatures.

Supplied in blocks or in sheets, the new carbon offers interesting engineering possibilities for impregnation or for use as filter plates in certain applications. Its extremely fine grain results in a large carbon surface area despite the high porosity of the material.

Stackpole porous carbon is available either in blocks or in sheets up to approximately 10" x 10" and of practically any desired thickness up to 1½".

ULTRA-MINIATURE TANTALUM CAPACITOR BY SPRAGUE

The first of a new series of tiny electrolytic capacitors employing tantalum as the anode was announced recently by the Sprague Electric Company as a new achievement in the company's drive toward miniaturization.

Trademarked "Tantalex," these capacitors are ideal for low voltage applications where they provide relatively large values of capacitance in a minimum of space. Use of tantalum, the most stable of all anodic film-forming materials, gives them unusual stability of performance. They exhibit no shelf aging under long periods of test . . . have extremely low leakage current.

Only 1/8" in diameter x 5/16" long, these Tantalex capacitors are ideal for bypass, coupling, and filter applications in low voltage transistor circuits. Other uses include transistor hearing aids and military amplifiers. Operating temperature range is —20° to +65°C, with outstanding resistance to severe humidity conditions.

Col. G. B. Hoffman, Director of Communications, FEAF, and Paul Whitestine, of Philco's Government and Industrial Division, test the first link of the Philco microwave system now being installed in the Kanto Plain area of Japan.

New Onan Engine Built To Military Specifications

A new lightweight (140 lbs.) 21 H.P. engine, first of its type and size to be manufactured to Military Standard Parts Specifications, has been announced by D. W. Onan & Sons, Inc. of Minneapolis, Minnesota.

This revolutionary new 2-cylinder, 4-cycle, air-cooled, gasoline-powered engine, designated the Onan Model "VB," is on the Qualified Products List, QPL-11275, under the 10 BHP size group. Its Qualification Reference Number is ENG-88-SE-77.

Suction cooling of the engine by a large centrifugal blower collects the hot air and discharges it through a single outlet, permitting satisfactory performance in a small compartment.

The Model "VB" will deliver a maximum of 19 H.P., with accessories, at 3600 RPM, assuring adequate power for scores of heavy-duty applications that require from 10 to 15 H.P. Basically equipped for manual starting using an integral, self-winding rope starter, the engine can be provided with electric starting if desired. Either conventional crankshaft extension or flywheel drive can be furnished.

NEW UHF GRID-DIP OSCILLATOR

Measurements Corporation, a subsidiary of Thomas A. Edison, Inc., is in production on a Grid-Dip Oscillator for applications in the UHF band.

Designated the Model 59-UHF Megacycle Meter, this instrument covers the range of 430 to 940 Megacycles. It incorporates a unique oscillator with a split-stator tuning condenser, arranged so that a fixed coupling point is at the center of the oscillator inductance.

Coupling sensitivity is excellent and grid current variation is minimal over the entire band. The oscillator output is either CW or 120-cycle modulated. Linear calibration is provided with a calibration point every 10 megacycles (individually calibrated) and accuracy is better than 25%.

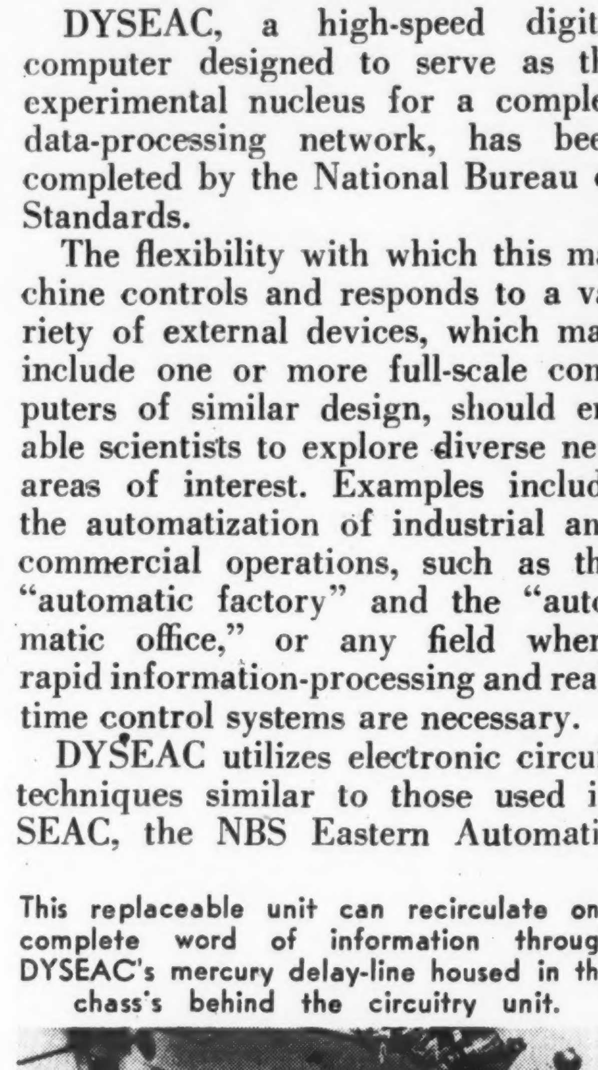
DYSEAC—New NBS Electronic Computer Completed

DYSEAC, a high-speed digital computer designed to serve as the experimental nucleus for a complex data-processing network, has been completed by the National Bureau of Standards.

The flexibility with which this machine controls and responds to a variety of external devices, which may include one or more full-scale computers of similar design, should enable scientists to explore diverse new areas of interest. Examples include the automatization of industrial and commercial operations, such as the "automatic factory" and the "automatic office," or any field where rapid information-processing and real-time control systems are necessary.

DYSEAC utilizes electronic circuit techniques similar to those used in SEAC, the NBS Eastern Automatic

This replaceable unit can recirculate one complete word of information through DYSEAC's mercury delay-line housed in the chassis behind the circuitry unit.



Computer. These dynamic circuitry techniques involve the performance of all logical operations by diode gating, the use of electrical delay lines for all incidental pulse storage, and the use of transformer-coupled pulse amplifiers utilizing only one tube type for all amplification.

Several special logical design features enable the computer to communicate in an extremely flexible manner with a large group of external devices.

Among the devices which may be attached to the computer are those that store, tabulate, file, convert, display, and sense information; or devices that actuate mechanisms such as servo equipment in response to signals sent out by the computer as a result of information being processed within it.

Gray Announces PhonAudograph III

A new system providing dictation facilities at the lowest cost in the history of the dictation equipment industry has recently been announced by the Gray Manufacturing Company.

The new product, called the PhonAudograph III, provides dictation equipment for as much as one-third less than comparable competitive systems and promises to open up large markets previously closed to the industry because of cost factors, according to Walter E. Ditmars, president of the company. The system will have an impact on the industry similar to the introduction of the first electronic dictating machine after World War II, he predicted.

The system utilizes a single centrally-located recorder, to which may be connected from one to 12 individual dictating instruments, resembling standard telephone handsets.

Among the features of the PhonAudograph I system, introduced by Gray two years ago, which are retained in the new PhonAudograph III are, push button control of playback, marking of corrections, marking of end-of-letters, and direct communication with the recorder attendant through the user's dictation instrument. Other stations are "locked out" when a dictator is using the system, thus insuring privacy.

Should an executive wish to dictate at a time when the recorder is being used for transcription, he simply presses one of the three push buttons on the base of his instrument, signaling that he wishes to have the use of the machine. He will quickly be "told" automatically, by the ending of a warning tone in his earpiece, that the unit is ready to receive his dictation. A separate transcribing machine can be used in cases where there is a heavy volume of dictation.

AFCA Member Heads Review Group On MIL Parts Specs

Leon Podolsky, Technical Assistant to the president of the Sprague Electric Company of North Adams, Massachusetts and a member of the Boston Chapter of the AFCA, has recently been appointed chairman of a new group to review all military electronic component part specifications.

This new group has been set up with a view toward improving the performance of these components in the light of equipment requirements for new, high reliability applications.

Mr. Podolsky was requested to undertake chairmanship of this ad hoc group by M. Barry Carlton of the Office of the Assistant Secretary of Defense for Applications Engineering.

During World War II Mr. Podolsky headed similar military task force engineering committees.

The need for the present program arises in the very large numbers of electronic components which appear in modern electronic systems, such as guided missiles, radar warning nets, and navigation systems, where there are many thousands of components in comparison to a few dozen which appeared in World War II electronic systems.

TEXAS TOWERS

Off-shore radar warning stations, known as "Texas Towers," will be constructed along the East Coast of the United States to furnish radar warnings and weather data.

These stations will be located approximately 100 miles off the coast and will be linked with the shore-based warning network used in the over-all defense of the United States.

Each station will include housing facilities for the radar and weather equipment and sufficient shelter for a crew of over 30 personnel who will be stationed at the sites for 30-day periods or less. Space will be provided for helicopter landings and there will be docking facilities for the re-supply of each station.

Station platforms will be built on pilings and raised above the high-water mark at a safe height to protect them from severe weather conditions. They will be located above the ocean floor where the water is shallow enough to permit construction.

The United States Air Force has designated the Bureau of Yards and Docks as the construction agency in this project for which eight million dollars has been authorized. Each station will cost over one million dollars for basic construction without specialized equipment.

NEW OSCILLOSCOPE FROM PRECISION APPARATUS

In response to industrial and service demand for a reliable, factory-made, general purpose oscilloscope at low price, Precision Apparatus Co., Inc., Elmhurst, New York, announces the Model ES-520, 5" Oscilloscope.

General specifications of the ES-520 Oscilloscope are: Push-pull vertical and horizontal drive; 20 millivolts per inch vertical sensitivity; 50 millivolts per inch horizontal sensitivity; 3-step frequency-compensated, vertical input attenuator; vertical frequency response 20 cycles to 500 KC within 2 DB; excellent vertical square wave response from 20 cycles to 50 KC; frequency response 20 cycles to 200 KC within 3 db (at full gain); 1 volt, peak-to-peak, built-in vertical voltage calibrater.

First photo of the Sperry 4,000,000-watt klystron designed to power an advanced Air Force radar. The eight-foot giant, prototype for a series of the military's most powerful microwave tubes, is shown undergoing installation in a high-power radar transmitter room at Rome Air Development Center, Griffiss AFB, N. Y.

TELEVISION

Tactical Television Demonstrated at Fort Meade

Top ranking Army officers, industrial leaders and members of the nation's press witnessed for the first time the Army's "command post of the future," equipped with television "eyes" that enable the combat commander to see and influence the course of battle.

High-ranking United States Army participants were headed by the Army's Chief of Staff, General Matthew B. Ridgway. Lieutenant General Floyd L. Parks, Commanding General of the Second Army, in whose area the demonstration was held, Major General George I. Back, Chief Signal Officer, and Brigadier General David Sarnoff, Chairman of the Board of the Radio Corporation of America, also had principal parts in the demonstration.

A phase of the action was covered by color television cameras of the National Broadcasting Company for a nationwide color telecast that was viewed at the White House and the Pentagon. This was intended to demonstrate the practicability of future military television communications between a theater of operations and headquarters in Washington.

The tactical use of television was presented jointly by the United States Army Signal Corps and RCA, employing the current black-and-white combat television equipment of the Signal Corps.

In the command post set up for the event, images from tactical TV cameras on the ground and in the air gave the commander and the audience an instantaneous view of widely separated actions along the simulated front, showing the movement of friendly troops and carrying intelligence of "enemy" preparations for counter-attack.

Coverage in the combat area was provided for the unit by three RCA Vidicon television cameras, each carried by a single cameraman and feeding back to a transmitter built into a ¾ ton truck. From each truck, the television image was transmitted by microwave relay to a larger monitoring truck located near headquarters.

The airborne system comprised two larger RCA cameras mounted in an L-20 reconnaissance plane—one of the cameras being fixed to cover terrain directly below the plane—and the other set on a movable mounting to permit oblique views of the surrounding areas. Information from the airborne cameras was transmitted directly from the plane to the mobile monitoring unit.

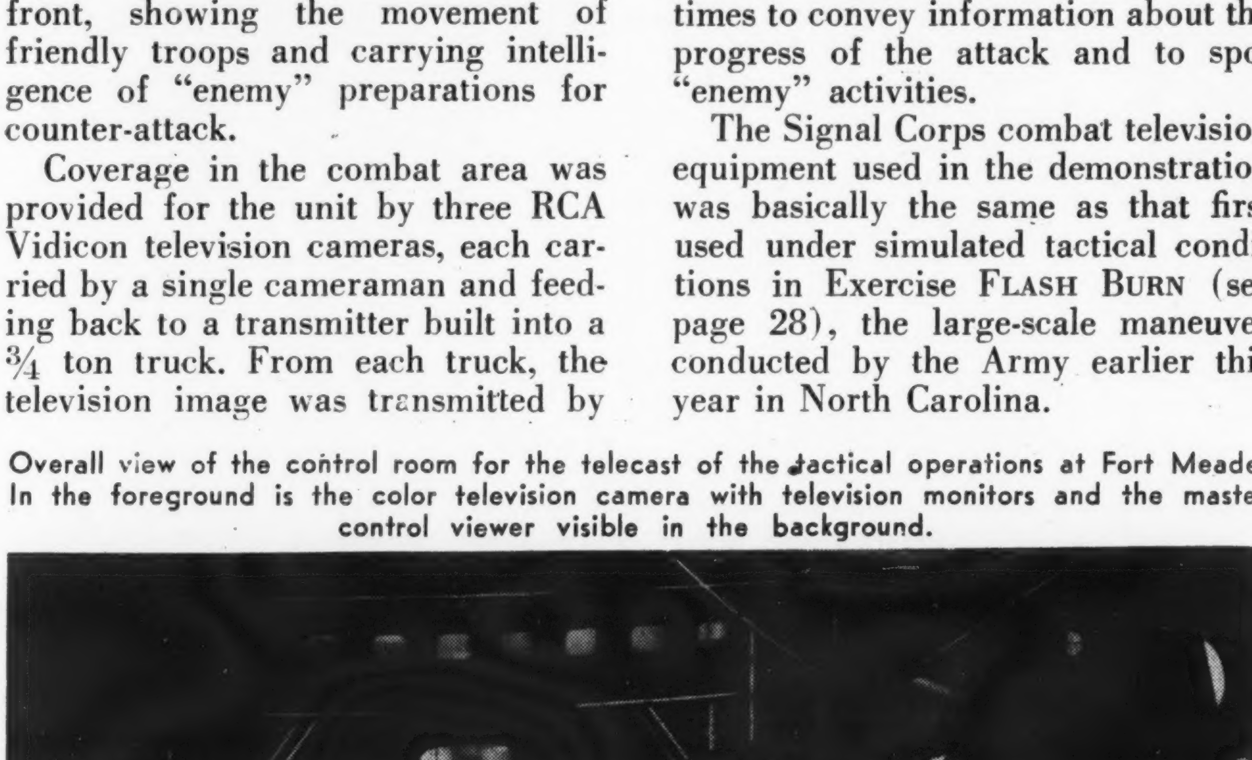
The command post, set up in a large tent to accommodate the press and official visitors, was arranged to represent the field headquarters of an armored cavalry regiment equipped with full combat television facilities. As combat cameras in the field, including an airborne unit, covered their assigned areas of action, scenes from various parts of the simulated battlefield appeared on small-screen monitors at the command post.

Acting on the orders of the regimental commander, Signal Corps television technicians at a switching panel in the tent caused the image from any one of the nine cameras to appear on a large television receiver located in front of the commander's field desk.

The airborne television camera, carried in an L-20 reconnaissance plane, was brought into action several times to convey information about the progress of the attack and to spot "enemy" activities.

The Signal Corps combat television equipment used in the demonstration was basically the same as that first used under simulated tactical conditions in Exercise FLASH BURN (see page 28), the large-scale maneuver conducted by the Army earlier this year in North Carolina.

Overall view of the control room for the telecast of the tactical operations at Fort Meade. In the foreground is the color television camera with television monitors and the master control viewer visible in the background.



(l to r) Brig. Gen. David Sarnoff, RCA Chairman of the Board, Maj. Gen. George I. Back, Army Chief Signal Officer, and General Matthew B. Ridgway, Army Chief of Staff, discuss the RCA Vidicon camera during the tactical television demonstration on August 11th.

General Electric Announces Color TV For Education, Industry and Business

The General Electric Company has recently announced that it is ready to supply color television systems for closed circuit use in education, business and industry.

Pictures are not broadcast with this equipment as they are from a commercial TV station, but are piped from the television camera through coaxial lines or over microwave relays to home-type receivers or large screen television projectors.

The G-E closed circuit television system is composed of only four basic elements of equipment. These include the color camera, a small, compact unit; a camera control console, which, together with a remote control unit for controlling all elements of focusing, angulation, and lens selection, governs all adjustments pertinent to the transmission of the program; a rack-mounted power supply for providing a regulated source of DC power; and a receiver.

All equipment except the camera may be located remote from the scene being televised. Two types of receivers may be used, depending on the size of the group being shown the picture. One, for use with small groups, is similar to a home-type TV console. The other, featuring a specially designed optical system, projects the color images, free from registration problems, on to a six-foot screen.

The applications for closed circuit color television appear to be limited only by the imagination.

In the field of medical education, for example, closed circuit color television may well supplant the many-balconied surgical amphitheaters now used for teaching graduate medical students surgical techniques.

In manufacturing, the supervision of remotely controlled tools, machines, conveyors, and valves located in hazardous or closely confined areas, through the eyes of television, effectively assists in controlling the operation more precisely. Atomic and hydrogen bomb tests have been controlled with the aid of closed circuit television. In the steel-making industry, where the exact color of a charge in a blast furnace is significant, closed circuit color TV allows the operator a close look.

New 17-Inch 90-Degree Deflection Picture Tube From Westinghouse

A new 17-inch television picture tube is available from the Westinghouse Electric Corporation.

An improved bulb design permits 90-degree deflection and a weight reduction of 5½ pounds with a resulting overall length reduction of approximately three inches, compared to previous 17-inch models.

Two new types (17ATP4 and 17 ATP4-A), are available. Both are electrostatic-focus, and directly-viewed picture tubes of rectangular glass construction, with a nominal screen diagonal of 17 inches. Both tubes have external conductive coatings. The 17ATP4-A has an aluminized screen for increased picture brightness.

ADMIRAL TO PRODUCE 21-INCH COLOR TELEVISION RECEIVER

A 21-inch color television receiver providing a full 21-inch picture of 245 square inches at a price less than today's 19-inch set will be a reality by Christmas, according to Ross D. Siragusa, president of Admiral Corporation.

The 21-inch set will have a picture 25 per cent larger than the largest color tube now available—a 19-inch circular tube giving a picture only slightly larger than the standard 17-inch black and white tube. In addi-

(Continued on page 66)

tion, the new 21-inch color tube has a shorter neck permitting lower production costs by the use of a smaller cabinet.

"With this development just ahead," Siragusa stated, "we will not produce any sets with the smaller round tubes and will move directly from the 15-inch set we introduced in January to the new 21-inch size."

The Admiral president also stated that Admiral has just put into production a battery of custom-made machines into which electrical components are automatically fed and from which come completely assembled units representing 30 per cent of a finished television chassis.

The long term outlook for the television industry is bright, Siragusa said. He expects TV sales for the industry to total 20,000,000 units in the next three years. By 1957 approximately 95 per cent of all American families will own a TV receiver just as they now have a radio.

Special Crystal for Color Purity in New TV Receivers

Low drift, 3579.545 kilocycle crystals for use in the sub-carrier oscillator circuits of color television receivers are available from Standard Piezo Co., Carlisle, Pa.

Known as the Standard Piezo Type TV-1, the new crystal is made to a frequency tolerance of 0.003 per cent over the temperature range from 20°C to 65°C. As used in color television circuits, the TV-1 crystal causes the receiver's sub-carrier oscillator to "lock" with the transmitter on every scan thereby maintaining absolute color purity over a wide range of temperature and circuit variations.

Shallcross Announces Delay Lines for Color TV

Delay lines for use as compensating delays for color television are now available from Shallcross Manufacturing Co., Collingdale, Pa.

Shallcross delay lines are also used for signal delays for television, and as coupling elements for wideband distributed type amplifiers.

A typical delay line consists of an eight section low loss filter having a rise time of 0.04 microseconds and delay of 0.3 microseconds. Maximum pulse voltage is 100 volts and the impedance is 500 ohms.

ARMY DEVELOPS SUPER-TV CHANNEL

Army engineers and scientists at Fort Monmouth have recently developed a supercommunications channel that greatly out performs the coaxial cable for multiple television network operations.

This new channel now transmits easily thirty or more complete television programs and the limit still seems far away. Its widest application is expected to be in the ultra-high frequencies, where several thousand more television stations may be on the air some day.

The Coles Signal Laboratory of the Signal Corps Engineering Laboratories has been carrying on experiments with the system for several years.

The new system, known as a "G-line," is simple, consisting of a single wire coated with an insulating compound. Its funnel-shaped "horns" launch and catch the waves sent over it. The waves do not pass along in the wire but over its surface, and are therefore known as "surface" waves.

The wires and insulation may be of any size or thickness. The important thing, according to Dr. Georg Goubau, the inventor, is that they be of a size to conform with the frequency of the program sent over it.

In a coaxial cable pipe, generally a single program may be carried. The G-line provides a channel many hundreds of times wider. Several television programs can be thrown in together and then sorted out at their respective destinations.

As many as a thousand TV programs may one day be carried cross-country over a single G-line. This new super channel is not expected to supersede the coaxial cable but to supplement it when more network channels are needed.

Sylvania Opens New TV Plant

Sylvania Electric Products Inc. recently dedicated its new 422,000-square-foot television set assembly plant, one of the nation's largest television set facilities, in Batavia, New York.

Many unique features of its manufacturing and storage areas were designed by engineers of Sylvania's Radio and Television Division, including a number of conveyor systems that have been described as completely new in industry.

In the process test area, television chassis are placed on a moving slat conveyor so that electrical tests can be made while each chassis is moving toward the next operation.

World's Smallest TV Station Serves Air Force Base

The world's smallest television station was officially opened during July at the remote Limestone Air Force Base at Limestone, Maine.

Colonel Bertram C. Harrison, Commander, 42nd Bombardment Wing, hailed the "Tom Thumb" television setup as a "truly significant experiment that we hope will be used as a pattern to bring television to U. S. military personnel stationed at isolated bases around the world."

The tiny, low-powered station has approximately one five-thousandths the wattage of the nation's largest commercial stations. With its maximum coverage range of only three miles, the Air Force station provides ten hours of major network programs daily for more than 15,000 personnel living on this 10,000-acre installation only a few miles from the Canadian border.

Conceived by General Curtis E. LeMay, Commander, Strategic Air Command, as an entertainment medium for personnel at isolated bases, the station was built by the Radio Corporation of America after General LeMay sought assistance from Brig. Gen. David Sarnoff, Chairman of the Board of RCA.

Equipment for the miniature eight-watt station, which transmits programs for a three mile radius was designed, built and erected at cost by RCA.

"The lessons learned by our engineers in simplifying and miniaturizing television equipment to be used by our Armed Forces enabled us to design and construct this miniature station," said Francis H. Engel, Assistant to the Vice-President and General Manager, Engineering Products Division of RCA.

Studios and transmitter facilities are housed in a "television shack"—ten by thirteen feet in area—constructed atop the four-story base hospital. On the air for approximately six months on an experimental basis, the station telecasts kinescope recordings of top network programs from the major broadcasting systems.

RCA engineers have adapted much of the existing equipment used in commercial television stations to provide the nucleus of the Limestone installation. The tiny vidicon camera used to pick up both live and filmed programs has found widespread applications in industry, as well as commercial television.

PERSONNEL CLEARING HOUSE

AFCA Members Available to Industry

The pages of SIGNAL are open to active AFCA *members* who are seeking positions in the communications, electronics and photographic industries. Any member is entitled to space free of charge in this column for three issues of the magazine. Please limit your notice to five lines. In replying, employers are asked to address: Box ______, SIGNAL, 1624 Eye Street, N. W., Washington 6, D. C. Letters will be forwarded to the AFCA member.

RESERVE COMMANDER, now active duty. Aeronautical communications electronics specialist. Airline and CAA background. Private pilot. Managerial or company representative type work preferred. Box 101.

REPRESENTATIVE for electronic manufacturer seeks new position as representative for small firm to Navy, Signal Corps and Air Force. Excellent background in government contact and commercial sales. Box 102.

PERSONNEL & labor relations manager, supervisor, operational administrator; twelve years progressively responsible military and civilian experience. Extensive background in training procedures and communications equipment. Degree supplemented by advanced technical training. Prefer location in southeast. Box 103.

PURCHASING EXECUTIVE. Navy, Signal Corps and Air Force electronics background. Knowledge of contract administration, material control. Box 104.

Government and Military Positions Available

Government and military agencies are invited to use this column to announce available positions which may be of interest to the readers of SIGNAL. Notices will be published three times if not cancelled before. Applicants apply as indicated in individual notices.

RADIO OPERATOR TECHNICIANS. Veterans $3400-$4200 to start. Overseas opportunities. Amateur or commercial licenses helpful. Full pay during advance training. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, private training, work experience, FCC licenses—if any. Armed Forces Communications Association will forward same immediately to employer who will acknowledge your application direct.

THE CORPS OF ENGINEERS' Research and Development Laboratories, located 20 miles south of Washington, D. C. at Fort Belvoir, Virginia, need several specialists in the field of electric power generation. Applicants must hold a degree in electrical engineering or have considerable practical experience in their field. Apply to Mr. Walter H. Spinks, Chief, Administrative Dept., ERDL, Ft. Belvoir, Va.

TELETYPE OPERATORS AND CRYPTOGRAPHIC TECHNICIANS. Veterans $3200-$3700 to start. Overseas opportunities. Full pay during training period. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, FCC licenses—if any. Armed Forces Communications Association will forward same immediately to employer who will acknowledge your application direct.

Applications are requested for electronic, aeronautical, mechanical, industrial engineering, editorial and photography positions located at the U. S. Naval Air Missile Test Center, Point Mugu, Port Hueneme, California. Applications, and requests for the complete Vacancy List of 39 available positions with salaries ranging from GS-5 to GS-13, should be addressed to: Mr. R. A. Riebow, Employment Superintendent, U. S. Naval Air Missile Test Center, Point Mugu, Port Hueneme, California. Some of the positions are:

ELECTRONIC ENGINEER, GS-13, to be Systems Development Engineer in the Office of the Senior Development Engineer, Range Instrumentation Department, NAMTC. Will accept personal responsibility for developing new or improved electronic systems for trajectory measurement in the Sea Test Range and associated data-reduction facility.

ELECTRONIC OR AERONAUTICAL ENGINEER, GS-9, for Sparrow III Division, Missile Test Department, NAMTC to prepare detailed test plans for conduct of ground and flight tests of missile systems in accordance with established overall test plans including timing of events, communications, flight paths, telemetering and photographic coverage.

PUBLICATIONS EDITOR—Engineering and Physical Sciences—GS-9, for Editing Division, Technical Information Department, NAMTC, to edit and write technical reports, provide consultation services in report writing and publication matters.

Radio

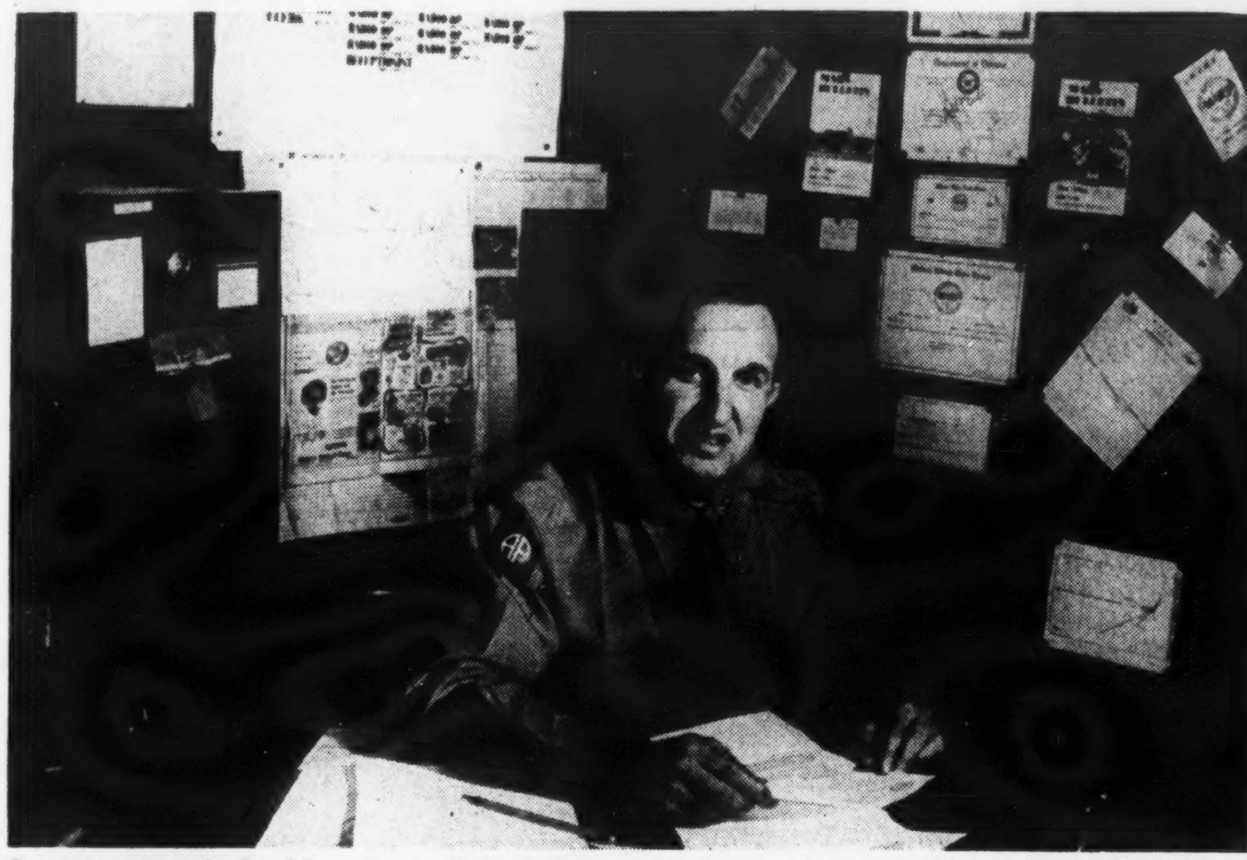
Military Amateurs

CAPTAIN FISCHLER HEADS MARS ARMY

Captain Joseph Fischler, Army Signal Corps, has been named Acting Chief, Military Affiliate Radio System (Army), replacing Major James A. Long who recently retired from the Army to enter private business.

Captain Fischler, a member of AFCA, has been actively engaged in military communications and radio for many years. He was assigned for duty with the Department of the Army Transmitting Station prior to joining MARS. His last overseas assignment was with a Signal Corps facility in the Philippine Commonwealth.

In his capacity as Chief, MARS (Army), Captain Fischler directs the Army MARS program for the Chief Signal Officer and coordinates joint aspects of MARS policy with his counterpart in the Air Force, Captain Walter S. Browne, Jr., Chief, MARS (Air Force).



Captain Joseph Fischler, Army Signal Corps, is shown above at his desk in the Military Affiliate Radio System office at the Pentagon. Recently named as Acting Chief of MARS (Army), he replaces Major James A. Long, SigC, former MARS Chief.

G-E Begins Search for Top "Ham" of 1954

A nation-wide search for the "key man" among the country's 100,000 amateur radio operators was recently announced by the General Electric Tube Department.

He will be the top "good neighbor" among "hams"—the one who performs the outstanding public service of 1954.

Anyone may nominate a "ham" for the award. Next February, G-E will present the winner the third annual Edison Radio Amateur Award, following selection by four impartial judges.

Winner of the 1954 award will be chosen for the "ham" activity which brings the greatest benefit to an individual or group, and for the amount of ingenuity and personal sacrifice displayed in performing the service.

The award rules states that anyone may nominate a "ham" as a candidate. Nominating letters should include the candidate's name, address, call letters, and a full description of the service performed.

The winner, and the person responsible for his nomination, will receive expense-paid trips to a centrally-located city for presentation of the Edison Award next February.

Judges will be E. Roland Harriman, president, American National Red Cross; Val Peterson, administrator, Federal Civil Defense Administration; Edward M. Webster, a member of the Federal Communications Commission; and Goodwin L. Dosland, president of the American Radio Relay League.

Nominating letters should be sent, before January 3, 1955, to: Edison Award Committee, General Electric Tube Department, Schenectady 5, New York.

North Carolina Amateur Youngest Air Force Mars Member

When MARS lowered the age limit from 21 to 16 for civilian members on 26 November 1953, the interest shown by the younger amateurs was tremendous.

One of the most active and youngest members of Air Force MARS is John H. Bauer, AF4AWM. John who is not quite 17 resides in Asheville, North Carolina and participates regularly in Eastern Net No. 2. His transmitter is a Viking I and the receiver an S-77. The antenna is an all-band affair and a BC-454-A is available for MARS CW operation.

Information about the Army or Air Force MARS program may be obtained by writing to: Chief, MARS (Army), Room BE-1000, The Pentagon, Washington 25, D. C.; MARS Command Director, Continental Air Command, Mitchel Air Force Base, New York.

Amateur Radio at NRL

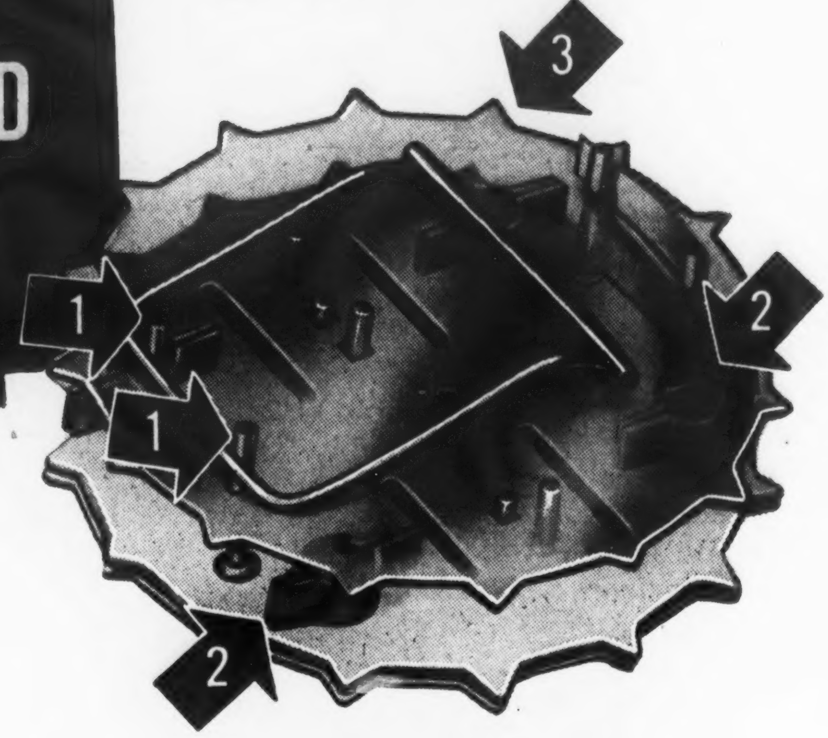
A new amateur radio station, W3NKF, owned and operated by the Naval Research Laboratory Amateur Radio Club, went on the air in Washington, D. C. on June 18.

The start of operation of the new amateur radio station recalled early work at NRL in the field of radio communications. During 1923 to 1943, the Laboratory radio station "NKF", which was established by presidential authority, worked with amateurs in connection with radio experiments. The primary operator at that time was Leo C. Young, now a consultant to the Laboratory's Radio Division. Pioneering work at NRL in the early 20's in cooperation with ra-

In G-E 5-Star Tubes—

CRITICAL PARTS ARE SPECIALLY ENGINEERED FOR STRENGTH!

Check sturdiness of this getter assembly!



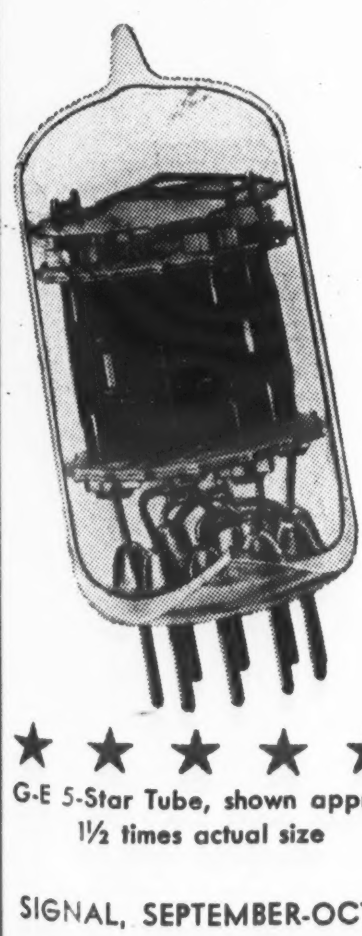
Parachute drops—jolts and jars involved in handling and transport—heavy gunfire—conditions like these tax standard-tube stamina to the limit . . . and beyond. Only 5-Star *designed-in* strength is adequate.

Also, G-E tube designers work on the basis that vibration is a normal hazard for 5-Star Tubes. From blueprints through special manufacture to final exacting tests, General Electric's aim is tube reliability in *all* circumstances.

Many million 5-Star Tubes now performing dependably where conditions are most severe, prove this aim is being realized. Ask for G-E 5-Star Tubes in new electronic equipment! Replace standard tubes with 5-Star types, for greater reliability! Interchange list on request. *Tube Department, General Electric Co., Schenectady 5, N. Y.*

G-E 5-STAR GL-5751

1. **G-E 5-Star getter is firmly double-staked for protection against shocks and vibration . . . whereas standard tube has a single-staked getter.**
2. **G-E 5-Star Tube has special welded stops on the vertical plate tabs that pass through the mica spacers. With standard tubes, the method is to crimp the tabs at this point.**
3. **Getter flash shield is strongly platformed on 4 uprights. (Flash shield is a 5-Star design feature in types where inter-electrode leakage can be especially harmful, such as the medium and high-mu twin triodes. Standard tubes have no flash shields.)**



★ ★ ★ ★ ★

G-E 5-Star Tube, shown approx 1½ times actual size

G-E 5-Star Tubes are the most reliable you can install! Among their many design features are:

- Double mica spacers at both top and bottom brace the internal structure, and enlarge the surfaces in contact with the glass envelope. Result: increased resistance to shocks and vibration.
- To give 5-Star Tubes greater strength, the tube cage is shorter and sturdier, and the cathode has been increased in diameter.
- Heater bends are specially coated a second time, to assure uniform insulation and minimize "shorts".
- In tubes where plate-grid leakage must be held to a minimum, special slots in the mica spacers act as barriers to electrical leakage.
- Critical grids are gold or silver-plated to minimize grid emission.
- Grid legs are smooth (not nicked) in order to assure a continuing tight fit where the legs pass through the mica spacers. This cuts down on grid vibration and microphonic noise.

GENERAL ELECTRIC

164-1A5

dio amateurs, sparked the use of the "high" radio frequencies, above 3000 kilocycles, as well as the use of crystals by the amateurs, for stable frequency control.

Mr. Young is trustee for the new employee radio station. Ethel M. Smith is president of the NRL Amateur Radio Club and Dr. Wayne C. Hall is president-elect.

Shown on the right are members of the Naval Research Laboratory Amateur Radio Club. Left to right Ethel M. Smith, Dr. Wayne C. Hall, and Leo C. Young at W3NKF.

SINGLE SIDEBAND DEMONSTRATED FOR PACIFIC COAST "HAMS"

A highlight of the Pacific Division Convention of the American Radio Relay League held at San Jose, California, July 3-5, was the MARS (Air Force) demonstration of single sideband technique. Equipment displayed consisted of a Hammarlund SP-600JX receiver adapted to SSB by a Crosby Laboratories Model 51 sideband selector.

In the demonstration a commercial or an amateur station using conventional modulation was selected. A BC-211 frequency meter, which was coupled to the input antenna, was tuned to within one kilocycle of the signal in order to provide a hetrodyne which would make normal communication impossible. By switching to either the upper or the lower sideband all interference was rejected.

The frequency locking effect inherent to this equipment was demonstrated by tuning in a station of only average signal strength adjacent to another station of greater signal strength. The antenna was removed and then replaced; the selected signal was still locked in despite loss of RF input.

Another demonstration involved copying two different stations, one on the upper sideband and another on the lower sideband, with equal readability.

In charge of the exhibit was Captain Walter S. Browne, Jr., USAF, Chief MARS (Air Force); Captain George Reeder, Headquarters Command MARS Director, USAF; and S/Sgt. Keith Hester, MARS Headquarters Station Technician.

Major Robert A. Wood, Office of the Secretary of Defense, spoke before the convention, and explained the role of the military in civil defense communications. He praised the Radio Amateur Civil Emergency Service (RACES) as a program which recognizes the value of the amateur radio operators in a national emergency and legally makes provision for him to exercise the privilege of serving his country as an amateur during the time of war.

He referred to MARS as ". . . . one comunication system in existence which could be expected to be capable of rendering considerable support to civil defense requirements."

Major Wood reiterated the MARS statement of intent with regard to MARS assistance to civil defense forces: "Within the current availability of personnel and equipment MARS may—

a. Make available communications services between the military forces in support of civil defense and the civil defense agencies.

b. Make available communications services for civil defense forces on a temporary or emergency basis when such services are not otherwise available.

c. Make available radio terminal facilities at desigated military installations for civil defense tie-in as required.

d. Make these services available on military frequencies assigned to established MARS networks."

Mrs. Jeanne Walker, Fayetteville, N. Y., W2BTB, is shown receiving the General Electric Edison Radio Amateur Award Special Citation from Dr. W. R. G. Baker, second from right, at a special ceremony at G-E Electronics Park, Syracuse, N. Y. Dr. Baker is a G-E vice president and general manager of the company's Electronics Division. At left is Mrs. Walker's husband, Richard M. Walker, W2ZOL, and right is Robert E. Lee, general manager of the G-E Cathode Ray Tube Department.

Mobile Unit Tours ROTC Summer Camps

Something extra was added to summer camps for cadets and prospective officers in the Third Army Area this summer. Approximately 4,300 ROTC students received supplementary training in the form of a practical demonstration of the Military Affiliate Radio System.

MARS Mobile Unit No. 1, assigned to MARS Headquarters, Washington, D. C., toured Fort Bragg, North Carolina; Camp Gordon, Georgia; Fort McClellan, Alabama, and Fort Campbell, Kentucky. The unit established a message center at each location and transmitted personal greetings from the cadets to their families and friends.

Sergeant Robert E. Gawryla, Corporal William Sturgeon and Private First Class Arthur G. Rate demonstrated the MARS equipment and explained the organization and purpose of MARS. All are members of the Army Signal Corps.

PHOTOGRAPHY

100" INFRA-RED LENS CAMERA MAKES PHOTOGRAPHIC HISTORY

COVER STORY

THE DEVELOPMENT OF A LARGE telescopic camera with an F/12.5 infrared lens that cuts through atmospheric haze up to 35 miles and records in detail tanks, jeeps, and personnel carriers six miles away was announced by the Signal Corps in late July.

Built with a special 100 inch telephoto lens, the camera can take battlefront pictures impossible with smaller-eyed cameras or when aerial photo flights are grounded. It has the largest and fastest infra-red eye ever built into a camera.

The Signal Corps developed two pilot models of the camera, one a box type and the other a "bazooka" type (see cover), each of which is readily portable and weighs about 100 pounds.

The special four-element lenses, made to Signal Corps specifications by Eastman Kodak Company, weigh about 40 pounds and are two feet long and 9½ inches in diameter. They cover about a four degree angle.

At the closest distance of operation, about 500 yards from the camera, the coverage is about 105 feet. At 20,000 yards or 11½ miles, the last setting before infinity, it gobbles up a 3,000 foot front, or about 3/5 mile, in its field of view. At the extreme ranges, the camera picture will cover about two miles in width.

The two type camera boxes, with different optical systems, are being tested and it is expected that the best features will be combined into a single unit.

The box type uses a beam bending or folding system to bounce the light in a "Z" line between a pair of 8 inch mirrors before registering on the film. Built by the Signal Corps, it is made of aluminum, 12" wide, 21" high and 32" long.

The bazooka type, built by Simmon Brothers, Inc. to Signal Corps specifications, has a long 58" magnesium gun type barrel in front of an aluminum back 12" long, 12" wide and 7" thick.

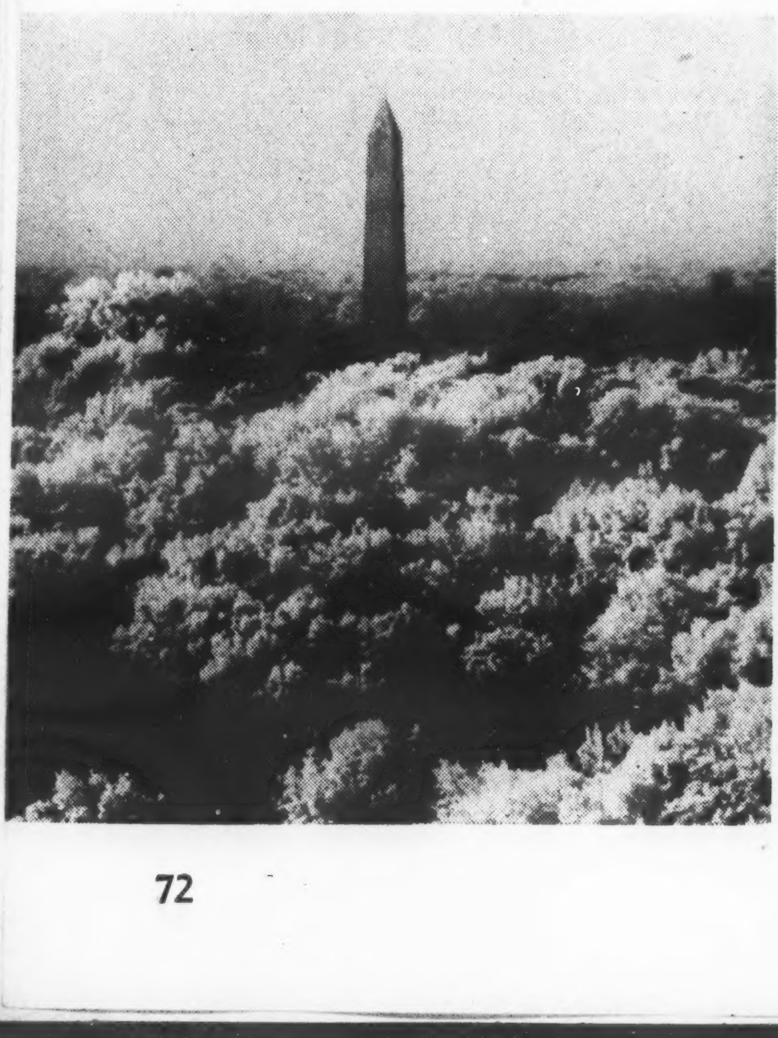
Terrestrial telescope peep sight viewfinders on both models can be sighted through either eye and, in combat areas, with the helmet on. In the second model, a reticle outline tells exactly what is recorded on the film.

The camera takes a 5 x 7 still picture with cut film or plates. It also has a roll film adapter that takes a 30 exposure roll. Not all thirty have to be taken before processing. If only a few pictures are needed, the lensman can slice off as many as he wants with a built-in knife. The remaining unused film is then fed into another take-up spool and shooting continues.

The shutter has 10 speeds, the fastest 1/200 second. Then come 1/100, 1/50, 1/25, 1/10, 1/4, 1/2, 1 second, bulb and time. A cable release triggers the shutter, lessening chances of camera movement.

The camera is operated by two men. On the cover, forground, Pfc. Jim R. Sarver sights through the terrestrial telescope peepsight and adjusts the leveller as Pfc. Robert Ayres clicks the shutter control at the camera back. The camera can be set up by two men and used in five minutes.

Left, the Washington Monument as it looks photographed from the 19th floor of the Naval Medical Center, Bethesda, Maryland, 11 miles away, with the Army's new long-range camera. The rest of the nation's capital lies hidden under tree tops and summer foliage. Contrast this photo with the image seen by an ordinary 4x5 press camera in the photograph at the right taken from the same vantage point. The Monument, circled, is barely visible. Only some of the Naval Center's buildings, a ball diamond, the golf links and neighboring homes are clearly seen.



PHOTOGRAPHY

NEW POLAROID LAND PICTURE-IN-A-MINUTE CAMERA

A new, smaller, lower-priced picture-in-a-minute camera termed the Highlander, has been announced by the Polaroid Corporation, Cambridge, Mass.

This newest version of the popular line of Polaroid cameras, now numbering three, uses a completely new film (Polaroid #31 ASA Speed 100) to turn out prints in the popular wallet size 2¾" x 3½"). These pictures are produced in essentially the same way as with the original Polaroid Land Camera—the shutter is snapped, a tab is pulled and 60 seconds later a completely dry picture requiring no further treatment is lifted out of the back of the camera.

Finished in gray with chrome trim, the camera is only 7½" long by 4½" wide, and 2½" thick when folded. This is small enough to fit into a coat pocket.

Shutter speeds range from 1/25 to 1/100 second while lens openings go from f/8.8 to f/50. The lenses are coated, front-element-focusing triplets. They can be focused from 3½ feet to infinity. Accessories include flash gun, exposure meter, carrying case, filter kit and close-up kit.

Bell & Howell Spider Turret and Sports Finder Camera

The new accessories designed for the 16mm professional cinematographer and the amateur who wants professional results, are offered by the Bell & Howell Co. of Chicago, Ill. The new turret permits an unlimited variety of lens combinations — any three lenses from 0.7 to 6 inches in focal lengths may be used without optical or mechanical interference.

The Spider Turret (l) and a Sports Finder (r) installed on a B&H 70-DL 16mm camera.

The Sports Finder, which may be used separately or in combination with the Spider Turret, is a giant reticle finder with 1, 2, 3 and 4 inch fields clearly marked, permits the cinematographer to see the action outside the "taking area" as well as that covered by the lens in use. Both accessories, the company claims, are "firsts" for a standard 16mm motion picture camera and the B&H 70-DL camera equipped with the turret and finder is available for immediate shipment. The accessories may also be installed on all 70-DL cameras in the field.

NEW LUBRICATING OIL FOR CAMERAS ANNOUNCED BY ELGIN

A new low temperature lubricating oil developed especially for cameras and other instruments has been announced by the Elgin National Watch Co., Elgin, Ill.

The new lubricant, a completely synthetic substance made by a still secret process, will lubricate at temperatures down below –100°F and is expected to eliminate one of the greatest single obstacles to successful operation of cameras and other instruments in arctic operations.

The oil is a direct result of developmental work the company has been doing on watch lubricants since 1938 and it is stated that the lubricant's versatility to widely varying temperatures, a factor extremely important in global operations, has been demonstrated in a year-long test with a group of timepieces.

FENJOHN UNDERWATER STILL CAMERA ANNOUNCED

A new underwater still camera with new tunnel sight, especially designed for professionals and serious amateurs, has been announced by Fenjohn Underwater Photo & Equipment Co. of Ardmore, Pa. Called the "Goggler" the new camera has all controls such as aperture, speed, film advance, focus, trigger and filter change, outside the housing and under control of the diver at all times.

The camera uses standard #120 or special 70mm film and film advance is by means of a sturdy hinged handle. Size of negative produced is 2¼" x 2¼" and one picture per second is possible. The camera is contained in a cast aluminum housing; machined anodized, impregnated and painted in orange. The housing can be pressurized to detect leaks and weighs 7 lbs. 11 oz. in air and 1 lb. 4 oz. underwater.

The Goggler is equipped with a 76mm f/3.5 color corrected Elgeet lens, and focusing underwater is from 2 feet to infinity. Filters and synchronized flash are available.

Fedco No. 400 Continuous Print Dryer

A new continuous print dryer with seamless drum called the No. 400 has been announced by Fedco Products of New York. The new dryer has a capacity of 40 to 50 8" x 10" single prints per hour, matte or glossy, and is equipped with a stainless seamless highly polished drum to provide prints with high gloss.

The dryer is equipped with built-in squeegee, variable speed drive, replaceable self aligning cloth belt, fan-cooled motor, and controlled heat which prevents scorching of prints. The dryer uses only 660 watts and operates on 120 volts A.C.

The dryer is small and compact and occupies only 18" x 24" table space and is 15" high. Shipping weight is 60 pounds. The lightweight and small size of the dryer makes it particularly useful in applications where a production type dryer is required because of space limitations.

Robot Royal 35mm Rapid Sequence Camera Unveiled

The new Robot Royal, the latest in rapid sequence cameras, has just been unveiled by the Intercontinental Marketing Corp. of New York, exclusive distributor of Robot cameras in the United States. In addition to its fully automatic, one-shot operation, the Robot Royal is equipped with an automatic sequence release which permits it to be fired in "bursts" of up to 24 pictures. The Royal will automatically transport film, wind and operate the shutter and operate the exposure counter as long as the release button is held down. The camera will take up to 24 uniformly exposed pictures in one burst and at any shutter speed, ½ to 1/500th of a second with one winding of its spring motor.

Cleanable Fluoroscopic Screen Developed by Du Pont

A new plastic cleanable fluoroscopic viewing screen, Type CB-2, has been developed by the Du Pont Co., to replace the non-cleanable Du Pont Type B-2 screen.

The new screen is unique in that it is readily cleanable and not adversely affected by humidity and fungus growth. The new type CB-2 provides the same image brilliance as the older, and has a longer life since its construction virtually eliminates hazards of damage in handling, installation and use.

FACSIMILE

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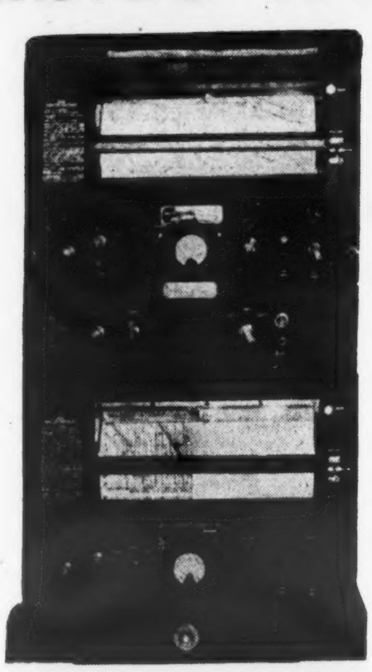

to supply vital weather data and predictions to their many subscribers. * Weathercasts of America furnish this information to maritime shippers, public utilities, and highway departments who depend upon it for their many operations affected by the weather. * These consultants, like others, rely upon the fast and accurate transmission and reception of data by Times Facsimile equipment.

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ELECTRONICS FOR EVERYONE. *By Monroe Upton. The Devin-Adair Company, New York, N. Y. 370 pages, $6.00.*

Electronics for Everyone explains in "human" and simple language how the great "electricians" of the past made the discoveries and inventions that gave us our condensers, batteries, and tubes; how later geniuses erected on the foundation thus laid the wonders of radio, radar, loran, high-fidelity phonograph reproduction, ground-controlled approach systems, television, and every other important application of electrical energy.

Electronics for Everyone contains the very latest electronic developments and is illustrated with several drawings. It leads gradually from the elementary to the more advanced phases of the subject, and brings to life the electrical greats of the past and present—Faraday, Volta, Tesla, Ohm, Ampere, Franklin, Edison, Farnsworth, and many others.

MICROWAVE THEORY AND TECHNIQUES. *By Herbert J. Reich, Philip F. Ordung, Herbert L. Krauss and John G. Skalnk. D. Van Nostrand Co., Inc., New York, N. Y. 901 pages, $12.50*

This book was written primarily as a textbook for a senior college or first year graduate course in Microwaves. However, a complete review has found that this text is a useful tool as a reference book for research workers and practicing engineers.

The book begins with vector arithmetic and a vector analysis of the various electromagnetic field theories. The first two chapters consist of discussions centering around such matters as retarded potential, basic type of plane waves, skin effect and the transmission line as a wave guide. A few specific problems are given at the conclusion of these chapters.

There follows a summarization of transmission line theory for the purpose of providing a steppingstone between lumped-element circuits encountered at audio frequencies and the wave guide used at ultra-high frequencies. The Smith Chart concerning its basic use in solving practical problems is reviewed and found complete and helpful.

An explanation of impedance matching utilizing various stubs and wave sections is followed by information on narrow and wide band baluns.

Next follows a discussion of wave guides, the field approach to guided plane waves, propagation, modes and their characteristics. This display of various modes characteristics in circular pipe and wave guide sections is a helpful and ready reference.

A thorough treatment of wave guide and coax line components is given with a short summary concerning antennas, parasitic elements and reflectors.

A short chapter on measurements is included outlining measurement of standing waves, balometers, and impedance determination. The student will find this chapter useful and helpful in laboratory problems.

The remaining portions of the book appear to be interesting from a design and reference point of view. A thorough discussion of microwave resonators, amplifiers and oscillators, and conventional tubes consisting of the klystron, reflex klystron, magnetrons and electron wave tube is included.

William W. Follin, President
Electronic Engineering &
Service Co., Inc.

Our Book Department can furnish any book currently in print. We will also help to secure older copies that you may need to complete your library. A 10% discount allowed all Association members on orders of $10 or more. Please indicate author and publisher where known and allow three weeks for delivery.

PHYSICAL METEOROLOGY. *By John C. Johnson. The Technology Press, Massachusetts Institute of Technology and John Wiley & Sons, Inc., New York, N. Y. 393 pages, $7.50.*

Much of the original research in topics forming the field of physical meteorology has been carried out by workers in other sciences—astronomers, radio physicists, aeronautical engineers.

It is only within the past few years that a significant effort has been made to form these divergent studies into a coherent, independent science. *Physical Meteorology* performs a notable service by bringing together, in a single volume, a comprehensive picture of this new branch of knowledge which in a comparatively short time has assumed great, and growing importance in a number of fields.

The book is planned to serve a dual purpose. It is designed to meet the needs of research workers in the many fields in which the atmosphere plays a significant role. At the same time, it is planned to fill the requirements of professional meteorological courses at the college level. The work presupposes no special background beyond basic physics and mathematics including differential and integral calculus.

THE BATTLE HISTORY OF THE 1ST ARMORED DIVISION. *By George F. Howe. Combat Forces Press, Washington, D. C. 471 pages, $6.50.*

Here is the battle history of the 1st Armored Division. This was the armored division which was the first to go overseas, the first to engage German troops in World War II, the first to land in Algeria and the first to enter Rome.

This division was the father, by an involved process of providing cadres, of the other 15 armored divisions in the Army during World War II.

But this is not a collection of statistics, or of famous firsts. It is, rather, the life story of the pioneer armored unit of our country's history. Here are the deeds of men and machines, the story of warfare on caterpillar treads and on wheels.

OPTICAL WORKSHOP PRINCIPLES. *2nd Edition. By Charles Deve and translated by Thomas L. Tippell. Hilger & Watts, Ltd., London, England. 436 pages, $8.75.*

Optical Workshop Principles has long been the accepted book in the field of optics and is considered one of the very few works extant that thoroughly covers this most interesting field of optical technology.

Although the book is primarily intended for the instruction and guidance of persons who are already familiar with the tools, techniques and routine operations of an optical workshop, this fact should not deter anyone, regardless of his particular interest in the field of optics, from gaining a great deal of useful knowledge in a field that is all too little known to the average user of optical instruments.

Deve's book is comprised of two parts. Part I consists of four chapters covering such subjects as glasses, their faults and aberrations; choice of materials; abrasions; glues; resins and cements; tools; polishes; and surfacing and spectacle lenses.

Part II comprises six chapters covering optical workshop methods with numerous recipes, the mechanical theory of the working of optical surfaces, optical tests in the workshop,

(Continued on page 78, col. 1)

BOOKS, continued

polarization of light, crystal shaping, centering and edging and cementing of lenses.

Several appendixes are devoted to such subjects as the superficial treatment of optical parts, the physical nature of light, and the kinematics of trueing, smoothing and polishing.

FRANK SMITH

HIGH FIDELITY. Gernsback Publications, Inc., New York, N. Y., $1.50.

Here is another publication, number 48, which has been added to the Gernsback Library.

High Fidelity is a truly down to earth publication, outlining the design, construction and measurement of the more popular audio systems.

If you are one of the many men who prefer to construct, design and experiment with your own audio systems, rather than work within the confines of a commercially available set up, you will find this publication practical and helpful.

W. W. F.

Make your plans now for the big 1955 AFCA Convention. May 19-20-21 at the Commodore Hotel, New York City.

The Signal Corps Transistor Program

(Continued from page 15)

as to some of the advantages which transistors can offer to the military. Since much of the future program for the next year or two will be based on these conclusions, they are reviewed here briefly.

1. The largest field of application of the present types of transistors, being low frequency, and low power devices, is in wire communications. It is felt that a considerable improvement in field communications, both in efficiency and cost, can be realized. Some applications are as follows:

a. Use of the transistor in the telephone as an amplifier may cut down central office power requirements by a factor of ten.

b. A practical field wire repeater will be feasible for the first time.

c. Telephone and telegraph carrier and repeater equipment for both wire and radio relay equipment can be considerably reduced in weight and power consumption. Further reduction in size of conventional equipment is not now feasible due to heat dissipation in vacuum tubes and to the power requirements. Contractual effort has been started for some of these applications.

d. Automatic electronic switching equipment for forward area use should be feasible.

Bearing in mind that by far the greater portion of communications in the Field Army is conducted over the wire system and that this system utilizes the only electrical means offering immunity from enemy countermeasures,technical improvements of the magnitude just mentioned are certainly of considerable significance.

2. The use of transistors in power conversion devices offers advantages which might greatly simplify and improve the battery development and power supply system for military electronics. Some possibilities in this regard are:

a. The many special types of batteries now required for voltages exceeding 24 volts and powers up to 6 watts could be replaced by a standard battery with transistor power conversion to provide the proper voltage and frequency. Over 35 of 45 current power supply projects to meet Army and Air Force requirements fall within this category. Some requirements could be met with present transistors and experimental models have been developed at SCEL. The majority must await development of power devices now believed feasible from laboratory results.

b. New military applications requiring unusual characteristics with respect to size, shape, weight, shock, vibration and spin cannot be met with conventional power conversion means such as mechanical vibrators, inverter circuits, dynamotors, etc. This requirement should be satisfied with transistor power conversion circuits.

c. High frequency power supplies can be provided which enable the use of smaller passive components.

3. With transistors, electronic equipment can be put to new uses heretofore impractical with conventional vacuum tube circuitry. Included in this category are computers, data transmission and other telemetering devices for forward area and airborne use including:

a. Small missile beacons.

b. Small computers for sound and flash ranging.

c. Airborne navigational aids.

d. Computing and telemetering devices.

e. Signalling from intrusion or surveillance devices.

4. Portable radio equipment now requires at least fifty per cent space and weight allowance for batteries. Transistors, when developed for the frequencies and power needed should permit an over-all reduction in weight and size of these sets by at least fifty per cent. Battery life under operating conditions should be increased severalfold. Circuitry studies now being undertaken will facilitate rapid development of such equipment once the proper transistors become available.

5. Other general benefits accruing to electronic equipment by reason of transistor characteristics are believed worthy of noting here.

a. Low heat dissipation. The temperature in conventional equipment is often so high due to heat radiated from vacuum tubes as to place the most stringent requirements on associated components. The use of transistors will alleviate this condition.

b. Transistors are particularly well adapted to circuit fabrication by means of auto-sembly techniques.

c. Some circuit elements can be simplified in design and use fewer passive components due to operating characteristics of transistors.

Since the ultimate objective of the entire program is the development and production of new and improved field equipment a logical question, and one that has been often repeated, is "When will some 'Transistorized' equipment be available for use in the field and what will the equipment be?"

A definite answer cannot be given to this question but we can provide a forecast. Within the present electronic limitations of currently available transistors there are a number of feasible developments. The most numerous are in the wire communications field. Engineering models of several items will be available this year. Should these models be satisfactory from an engineering standpoint, the normal course of development of service test equipment, testing and preparation of final specifications would indicate that production for field use could not be expected until some time in 1955.

Thereafter we can expect a constantly increasing flow of transistorized equipment into ever expanding fields of applications with the attendant advantages and improvements suggested by what has been mentioned here. By then reports such as this will be unnecessary as the results of the program will be evident to all.

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